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NOTES ON CEPHALOPOD GENERA; CHIEFLY COILED SILURIAN FORMS

AUG. F. FOERSTE

1. Introduction

The following notes begin with a discussion of some of the major divisions of the Nautiloid cephalopods proposed by Prof. Alphaeus Hyatt. This is followed by a discussion of certain species, chiefly Silurian, more or less erroneously referred to definitely established genera. A number of gyroceran and nautilian Niagaran species are then described in detail, and, finally, a description of a peculiar exogastric phragmoceroid Trenton species is appended. Several new genera are proposed, including *Quebecoceras*, *Levisoceras*, *Bickmorites*, *Jolietoceras*, *Tyrrelloceras*, *Graftonoceras*, *Oxygonioceras*, and *Antiphragmoceras*. The European genera *Uranoceras* and *Ophidioceras* are identified as occurring also in American strata. Several Silurian species are identified with the American Devonian genus *Gigantoceras*.

2. Acknowledgments

In the preparation of this paper the writer has drawn on the resources of every available museum. He is specially indebted to Prof. Stuart Weller, at the University of Chicago; and to Arthur Slocom, curator of the Walker Museum at that institution, from which most of the specimens here described were borrowed.

Others were loaned by Prof. John M. Clarke and Dr. Rudolph Ruedemann at the New York State Museum; Prof. Percy E. Raymond at Harvard University, and Samuel Henshaw, director of the Museum of Comparative Zoology at that institution; Dr. Ray S. Bassler of the U. S. National Museum, Dr. Chester A. Reeds, of the American Museum of Natural History, Dr. A. R. Crook of the Illinois State Museum of Natural History at Springfield, Illinois, Prof. J. E. Carman at Ohio State University, Dr. E. M. Kindle of the Victoria Memorial Museum at Ottawa, Canada, and others. To all of these the writer is under great obligations and without their assistance the studies here recorded could not have been made.

3. Holochoanoida and Ellipochoanoida

In his Genera of Fossil Cephalopods[1] Hyatt divided the nautiloid cephalopods into two major groups: the *Holochoanoida* and the *Ellipochoanoida*. In the *Holochoanoida* the siphuncle is formed solely by the series of septal funnels. Each septal funnel, in succession, extends backward the entire length of at least one camera; its lower margin is inserted into the upper part or neck of the septal funnel next beneath, and forms there a perfect closure along its entire circumference; the result is a continuous tube or siphuncle. In certain species or genera of the *Holochoanoida* the septal funnels extend conspicuously farther than the length of a single camera. In the *Ellipochoanoida* on the contrary the septal funnels are short, extending backward only a short distance into the camerae beneath, the intervals between successive septal funnels being much greater than the length of the septal funnels. These intervals are closed by distinct structures known as connecting rings. The resulting siphuncle, therefore, is composed of a series of septal funnels and connecting rings, alternating with each other, by far the greater part of the length of the siphuncle being formed by the connecting rings.

[1] Hyatt, Alphaeus, Genera of Fossil Cephalopods; Proc. Boston Soc. Nat. Hist., 22, 260 (1884).

In the *Holochoanoida* the septal funnels frequently present concave outlines along their exteriors, within the camerae, but where they come in contact with the neck of the funnel next beneath a reversal of curvature often is noticed, the lower end of one funnel invaginating for some distance into the upper end of the funnel next beneath. In other genera among the *Holochoanoida*, however, the septal funnels are tubular in form. So far, no species of *Holochoanoida* have been noted in which the septal funnels present convex exterior outlines along the greater part of their length within the camerae.

In the *Ellipochoanoida*, the connecting rings may be tubular or may be more or less inflated, presenting convex exterior outlines within the camerae. No species have been noted in which these connecting rings present concave outlines. Where the connecting rings are tubular in form, the short septal funnels do not curve outward at their lower margin. However, in proportion as the connecting rings are more strongly inflated, the lower margin of the septal funnels curves more strongly outward.

4. Orthochoanites and Cyrtochoanites

In the Zittel-Eastman Text-book of Paleontology, Hyatt replaces the term *Holochoanoida* with *Holochoanites*, and abandons the term *Ellipochoanoida* in favor of four new suborders, *Mixochoanites*, *Schistochoanites*, *Orthochoanites*, and *Cyrtochoanites*, of equal rank with *Holochoanites* as major divisions of the nautiloid cephalopods. *Mixochoanites* includes forms such as *Ascoceras* and *Billingsites*, with inflated gerontic living chambers. *Volborthella* has no relationship to this group, but should be associated with *Salterella*. *Schistochoanites* includes the single genus *Conoceras*. *Cyrtocerina* is not related to the latter, but to *Cyrtochoanites*.

Orthochoanites includes by far the greater part of the nautiloid cephalopods. In this group Hyatt states that the septal funnels, as a rule, are both longer and straighter than in *Cyrtochoanites*, and are not bent sharply outwards as in the latter group. The connecting rings or siphuncular segments may be slightly

nummuloidal, fusiform, or tubular, but never markedly nummuloidal.

Cyrtochoanites includes forms whose septal funnels, as a rule, are short, their lower margins bending outward. According to Hyatt, the siphuncle varies exceedingly, passing from tubular in the young, and even in full-grown primitive forms, to highly nummuloidal in the adults of specialized genera; but in some groups the siphuncle retains constantly its primitive character. *Eremoceras* and *Cyclostomiceras* are not related to this group, but to *Holochoanites*.

Cyrtochoanites includes two major divisions: *Annulosiphonata* and *Actinosiphonata*. In the former the interior of the siphuncle frequently is more or less obstructed by calcareous deposits which embrace the inner walls of the septal necks, usually forming ring-like structures. The latter may increase in size until successive rings meet at or above mid-height within the camerae. This structure is characteristic of the *Actinoceratidae*. In the *Actinosiphonata*, vertical laminae extend from the walls of the connecting rings inward, but do not actually reach the center of the siphuncle. They present an appearance quite similar to that of certain species of corals, in which the septa do not reach the center of the corallites. Many of the Phragmoceroids, and Trimeroceroids, also *Tripleuroceras*, *Mixosiphonoceras* and typical *Cyrtoceras*, present this type of structure. The number of species having the actiniform type of siphuncle is very imperfectly known at present.

5. Trocholites, Plectoceras, and Litoceras

In his Genera of Fossil Cephalopods, Hyatt stated that the siphuncles of *Trocholites*, *Plectoceras*, and *Litoceras* appear to be holochoanoidal, but that the structure of these siphuncles in reality might be similar to that of *Aturia*,[2] in which the septal funnels are excessively long, and the connecting rings are reduced to a minimum. It should be noted, however, that the three genera first named are of Canadian and Ordovician age,

[2] Zittel-Eastman, Textbook of Paleontology, Fig. 1118 (1913).

while *Aturia* includes only Tertiary forms. Analogies drawn from *Aturia*, however, are liable to prove deceptive when applied to species of Canadian or Ordovician age.

In the Zittel-Eastman Text-book of Paleontology, Hyatt places the three genera named above in his sub-order *Orthochoanites*, thus excluding them there definitely from the *Holochoanites*. All three genera are included in this text-book in Hyatt's subdivision *Plectoceratida*, one of the eight major subdivisions of the *Orthochoanites*. Whether Hyatt had some reason for assigning these genera to the *Orthochoanites*, aside from the analogy presented by *Aturia* is unknown, but to the present writer the structure of these genera appears holochoanoidal, as it did to Hyatt at the time of publication of his Genera of Fossil Cephalopods, in 1884.

6. Tarphyceratidae, Trocholitidae and Plectoceratidae

Among the *Tarphyceratidae* Hyatt includes the genera *Aphetoceras*, *Deltoceras*, *Barrandeoceras*, *Tarphyceras*, *Planctoceras*, *Eurystomites*, and *Falcilituites*. Of this group, the American genera *Aphetoceras*, *Deltoceras*, *Barrandeoceras*, *Tarphyceras*, and *Eurystomites* are similar in presenting narrow, tubular siphuncles, apparently holochoanoidal in structure, chiefly of Canadian and Chazyan age, though certain species occur also in the Black River. With the exception of *Barrandeoceras*, the siphuncle of these American genera lies near the ventral wall of the conch. In these genera the conch is compressed laterally.

Among the *Trocholitidae* Hyatt includes the genera *Schroederoceras*, *Litoceras*, *Trocholitoceras*, *Trocholites*, and *Discoceras*. Of this group, the American genera *Schroederoceras*, *Litoceras*, *Trocholitoceras*, and *Trocholites* also present narrow, tubular siphuncles, apparently holochoanoidal in structure, but the conch is depressed dorso-ventrally, the cross-sections tend to be reniform, and in mature forms the siphuncle is near the dorsal wall of the conch. All of the genera named have representatives in the Canadian, *Litoceras* occurs also in the Chazyan, and *Trocholites* occurs also in the Trenton and Cincinnatian. The species orginally described by Billings as *Nautilus hercules*,

and that described by Whiteaves as *Apsidoceras insigne*, do not belong to the genus *Litoceras*. The first is referred to *Characteroceras* Foerste, and the second is regarded as a true *Apsidoceras*. Nothing is known of the structure of the siphuncle of the Cincinnatian species of *Trocholites*.

Among the *Plectoceratidae* Hyatt includes the genera *Plectoceras* and *Sphyradoceras*. Of these, typical species of *Plectoceras* also appear to have tubular siphuncles, holochoanoidal in structure. These species occur in the Chazyan and Black River. To these species the form originally described by Whitfield as *Lituites bickmoreanus* is not related, the latter being ellipochoanoidal and belonging undoubtedly to the sub-order *Orthochoanites*. This is true also of all species included in the genus *Sphyradoceras*.

The relationship of *Plectoceras* appears to be with those holochoanoidal genera included by Hyatt under the *Tarphyceratidae* in which the siphuncle is located close to the ventral wall of the conch. In that case, the *Tarphyceratidae* could be restricted provisionally to the genera *Aphetoceras*, *Deltoceras*, *Tarphyceras*, *Eurystomites*, and *Plectoceras*.

Barrandeoceras might be placed provisionally in a distinct family, its siphuncle being sufficiently different in location, its position being only slightly ventrad from the center of the conch, instead of strongly ventrad, as in the typical genera here listed. It may be regarded as a form derived from the same ancestry as the *Tarphyceratidae*, but along a line sufficiently divergent to form the basis of a distinct group in classification.

The *Trocholitidae* could be restricted provisionally to the genera *Schroederoceras*, *Litoceras*, *Trocholitoceras*, and *Trocholites*.

When thus restricted, the families *Tarphyceratidae*, *Trocholitidae*, and *Barrandeoceratidae* apparently could be removed from the *Orthochoanites* to the *Holochoanites*.

7. Schroederoceras

The specimen of *Schroederoceras cassinense* Whitfield shown by Dr. Ruedemann as figure 36 on page 477 of his report on the

Cephalopoda of the Beekmantown and Chazy Formations,[3] however, suggests ellipochoanoidal structure in the presence of short septal necks, the connecting siphuncular segments being less distinctly defined as narrow dotted areas. Possibly these connecting siphuncular segments correspond to connecting rings, though they present concave exterior outlines as in the *Holochoanites*.

However, the essential characteristic of the *Holochoanites* is not the concave exterior vertical outline of the segments of the siphuncle within the individual camerae, but the building up of the siphuncle from a single series of components, namely, the septal necks which are sufficiently long to descend the entire length of at least a single camera and invaginate into the upper part of the septal neck next beneath.

While the specimen figured by Dr. Ruedemann suggests a series of short septal necks connected by intervening siphuncular elements which may correspond to connecting rings, all of the sections of the siphuncle of various species of the *Trocholitidae* and *Tarphyceratidae* examined by the present writer suggested the building up of the siphuncles from a single series of greatly elongated septal necks. Hence, the families mentioned are regarded, at least provisionally, as holochoanoidal. However, the doubt cast on this conclusion by the specimen figured by Dr. Ruedemann must be admitted. Further study of this problem is necessary.

8. Protocycloceras and Orygoceras

The holochoanitic structure of *Protocycloceras* is described by Dr. Ruedemann in the following terms[4]

> . . . . the septal necks are . . . . complete and extending from one septum to the plane of the preceding one. . . . . These funnels grow first toward the interior of the siphuncle and then again outward thus producing contractions of the siphuncular space between the septa. . . . . Hyatt has placed his genus Protocycloceras under the suborder Orthochoanites (with the Cycloceratidae)

[3] Ruedemann, New York State Museum Bul. 90, 477 (1906).
[4] Loc. cit., 440.

If the above stated observation of the structure of the ectosiphuncle of *P. lamarcki* is correct, that form is to be referred to the Holochoanites.

Ruedemann figures this holochoanoidal structure clearly[5] in the case of *Protocycloceras whitfieldi* Ruedemann. Apparently a similar structure is indicated by his figure,[6] illustrating the siphuncle of *Orygoceras cornuoryx* (Whitfield). In the latter case, however, he states definitely: "The structure of the siphuncular wall shows this genus (Orygoceras) to belong to the Orthochoanites. The wall like that of the Orthoceratidae is composed of short straight septal necks and connecting sheaths." Unfortunately, the published figure does not show where, in his opinion, the septal necks terminate and where the connecting rings begin.

9. Ellesmereoceras

Ellesmereoceras was founded on a species of Endoceroid in which the septa rise toward the ventral side of the conch; the siphuncle is very small compared with the cross-section of the conch, and is in contact with the ventral wall; the conch is strongly compressed laterally.[7] Endocones may have been present, but none were detected in the only specimen at hand, and they are supposed to be absent. For further information see this Journal, vol. 20, 265 (1921).

10. Cyrtendoceras and Clarkoceras

The genus *Cyrtendoceras* was described by Remele[8] in the following terms, (translated freely)

With strongly sickle-shaped lengthwise curvature, exactly as in *Cyrtoceras*. Conch increasing very gradually in size, with numerous camerae. Most noteworthy is the fact that the siphuncle is located

[5] Loc. cit., 444, Figs. 17a and 17b.

[6] Loc. cit., 451, Fig. 20.

[7] Foerste, A. F., Notes on Arctic Ordovician and Silurian Cephalopds: Denison Univ. Jour. Sci. Lab., 19, 265; pl. 27, figs. 3 A, B, C; pl. 33, fig. 3 (1921).

[8] Remele, Tageblatt der 59. Versammlung Deutscher Naturforscher u. Aerzte zu Berlin, 338 (Sept., 1886).

in contact with the concave side of the conch. It agrees with the invaginating forms of *Orthoceras* (*Endoceras* Hall) not only in this marginal position of its siphuncle but also in the structure of the latter. The siphuncle, namely, is crossed at intervals, which correspond in location to the septa between the camerae, by oblique transverse rings, which locate the terminations of the back-ward directed septal necks.

Remele's genotype evidently was not a small specimen, since he used the expression "von ansehnlicher Groesse" in describing its size.

It was found in erratic Ordovician material in the vicinity of Wriezen, in the province of Brandenburg, in northern Germany. It was found associated with *Echinosphaerites aurantium* (Gyllenhal), *Illaenus centaurus* Angelin, and *Suecoceras barrandei* Dewitz. The species *Illaenus centaurus* Angelin is known at present as *Illaenus chiron* Holm, the former name being preoccupied.[9] *Illaenus chiron* and *Suecoceras barrandei* occur both in the *Chiron* limestone and in the *Platyurus* limestone,[10] which correspond to the lower and middle Chazyan of New York.[11]

Two species described by Holm[12] possibly may belong to *Cyrtendoceras*. These are *Cyrtocerina hircus* Holm from the Lituitkalk of Oeland, and *Cyrtocerina schmidti* Holm from the Echinosphaeritenkalk. The horizons mentioned correspond approximately to the lower and upper Chazyan. In both cases the segments of the siphuncle within the camerae present concave vertical outlines.

Dr. Ruedemann referred to this genus a species from the Beekmantown of New York, under the name *Cyrtendoceras* (?) *priscum*.

The species originally described as *Piloceras newtonwinchelli* by Clarke[13] from the Shakopee member of the Canadian of Minnesota, was later made the genotype of the new genus

[9] Bul. Geol. Inst. Univ. Upsala, 8, 84 (1908).
[10] Loc. cit., 98 and 102.
[11] Bul. Mus. Comp. Zool., xx, 56, No. 3, pl. 8 (1916).
[12] Holm, Geol. Forenhandl. i Stockholm, 17, (1895).
[13] Clarke, Geol. Minnesota, 3 pt. 2, 767, figs. 8, 9; pl. 47, figs 1, 2, 3 (1897).

Clarkoceras by Dr. Ruedemann.[14] Dr. Ruedemann agrees with Prof. Clarke in his interpretation of the structure of the siphuncle of *Clarkoceras*, regarding it as belonging to the *Orthochoanites* instead of the *Holochoanites*. However, the presence of distinct endocones, and the concave outlines of the siphuncular segments within the camerae suggest a holochoanoidal structure. The genus is characterized by the distinct distance of the siphuncle from the ventral wall of the conch.

11. **Quebecoceras** Gen. nov.

The species *Cyrtoceras quebecense*, described by Whiteaves[15] from the Levis member of the Canadian, opposite Quebec, Canada, agrees with *Cyrtendoceras* in having a slowly enlarging conch with a holochoanoidal siphuncle in contact with the concave ventral wall of the conch. However, the lengthwise curvature of the conch is only moderate, and this causes the conch to present such a different appearance as to suggest the presence of a distinct genus. For this, the term *Quebecoceras* here is proposed, with *Cyrtoceras quebecense* Whiteaves as the genotype. It differs from *Clarkoceras* in having the siphuncle in contact with the ventral wall of the conch.

The species described by Billings as *Orthoceras missisquoi* and *Orthoceras edax*[16] apparently belong to the same group as *Quebecoceras quebecense* (Whiteaves).

12. **Levisoceras** Gen. nov.

The genotype of *Cyrtocerina*, namely *Cyrtocerina typica* Billings, from the Black River formation of the Ottawa River area, in Canada, is distinctly an ellipochoanoidal species; but *Cyrtocerina mercurius* Billings, from the Levis member of the Canadian, opposite Quebec, in Canada, is apparently a holochoanoidal form, presenting concave vertical outlines along the exterior of the segments of the siphuncle, within the camerae. For this

[14] Ruedemann, Bul. N. Y. State Museum, 80, 336–7, figs. 25 and 26 (1905).
[15] Whiteaves, Pal. Foss. 3, Geol. Surv. Canada, 315, pl. 35, figs. 1, 1a (1905).
[16] Billings, Pal. Foss. 1, Geol. Surv. Canada, 314 and 349 (1865).

form the generic term *Levisoceras* here is proposed, with *Cyrtocerina mercurius* Billings as the genotype.[17]

In this species the curvature corresponds approximately to that of *Cyrtendoceras*, but the rate of enlargement of the conch in a dorso-ventral direction is much greater. From *Clarkoceras* this species differs by its greater lengthwise curvature, and the contact of its siphuncle with the ventral wall of the conch. From *Quebecoceras* it differs in its greater rate of enlargement and much greater lengthwise curvature.

The species described as *Clarkoceras holtedahli* Foerste differs from *Clarkoceras newtonwinchelli* (Clarke) in its greater rate of enlargement and in the much nearer approach of its siphuncle to the ventral wall of the conch. From *Quebecoceras quebecense* (Whiteaves) it differs in the much smaller rate of enlargement of its conch. From both *Cyrtendoceras* and *Levisoceras* it differs and its much smaller lengthwise curvature.

13. Eremoceras and Cyclostomiceras

In *Eremoceras syphax* (Billings), the genotype of Hyatt's genus *Eremoceras*, the siphuncle is flattened against the ventral wall of the conch, and the siphuncular segments within the camerae curve slightly inward in vertical sections, suggesting affinity to the *Holochoanites*.[18]

The genotype of *Cyclostomiceras*, namely, *Cyclostomiceras cassinense* (Whitfield) is figured by Dr. Ruedemann[19] as having the siphuncular segments, within the camerae, with concave vertical outlines, as in *Holochoanites*. The location of the siphuncle is endogastric, its outer margin being about 2 mm. from the ventral wall of the conch, which is curved slightly less in a lengthwise direction than the dorsal wall.[20] The species described originally as *Cyrtoceras orodes* Billings, and *Cyrtoceras*

[17] Loc. cit., 193, fig. 179.

[18] Foerste, A. F., Notes on Arctic Ordovician and Silurian Cephalopods: Denison Univ. Jour. Sci. Lab., 19, 263, pl. 33, figs. 2, 8 A, B, C. (1921).

[19] Ruedemann, Bul. N. Y. State Museum, 90, 502, fig. 56 (1906).

[20] Loc. cit., pl. 37, fig. 3.

brevicorne Hall unquestionably are ellipochoanoidal in structure, and do not belong to *Cyclostomiceras*.

14. Genera of Holochoanites

In accordance with the preceding observations, the following classification of the American genera of *Holochoanites* is presented for consideration. It differs so much from the views of Hyatt, Clarke, Ruedemann, and others, that it is presented with considerable hesitation. The necessity for further research is admitted frankly, but it is hoped to enlist the interest of others, so that a more abundant quantity of material may be subjected to study.

In general, this list includes those forms in which the siphuncular segments, within the camerae, present concave vertical outlines. It is here assumed that these concave vertical outlines are confined to forms which have holochoanoidal siphuncles. Apparently such holochoanoidal structure was observed by the writer in all forms studied by him. Should, on further study, it turn out that concave vertical outlines occur in the siphuncular segments of strictly ellipochoanoidal siphuncles, the validity of the classification here presented would at once become questionable.

Holochoanites

Family 1. Endoceratidae Hyatt
- *Endoceras* Hall
- *Vaginoceras* Hyatt
- *Cyclendoceras* Grabau and Shimer
- *Cameroceras* Conrad
- *Ellesmereoceras* Foerste
- *Protoclycloceras* Hyatt

Family 2. Piloceratidae Hyatt
- *Piloceras* Salter

Family 3. Cyrtendoceratidae Hyatt
- *Cyrtendoceras* Remele
- *Levisoceras* Foerste
- *Clarkoceras* Ruedemann
- *Quebecoceras* Foerste

Family 4. Cyclostomiceratidae Nom. nov.
Cyclostomiceras Hyatt
Eremoceras Hyatt
Family 5. Tarphyceratidae Hyatt
Tarphyceras Hyatt
Aphetoceras Hyatt
Deltoceras Hyatt
Eurystomites Schroeder
Plectoceras Hyatt
Family 6. Barrandeoceras Nom. nov.
Barrandeoceras Hyatt
Family 7. Trocholitidae
Trocholites Conrad
Schroederoceras Hyatt
Litoceras Hyatt
Trocholitoceras Hyatt

15. Stratigraphical Distribution of Holochoanites

If the grouping of genera under *Holochoanites*, as just proposed, be accepted, then apparently *Holochoanites* prevails in Ozarkian and Canadian strata, to the exclusion of the ellipochoanoidal cephalopods; at least no ellipochoanoidal species, in that case, are known in American strata of that age.

In Chazyan strata both orthoconic and cyrtoceraconic ellipochoanoidal cephalopods are known. Such forms as *Orthoceras vagum* Ruedemann, *Orthoceras lentum* Ruedemann, *Spyroceras clintoni* (Miller), *Loxoceras moniliforme* (Hall), *Oncoceras pristinum* Ruedemann, *Cyrtactinoceras champlainense* Ruedemann, *Cyrtactinoceras boycii* (Whitfield), *Gonioceras chaziense* Ruedemann, *Ooceras lativentrum* Ruedemann, *Ooceras perkinsi* Ruedemann, and *Ooceras seelyi* Ruedemann, evidently are of ellipochoanoidal structure. Of these, *Spyroceras clintoni* makes its appearance in the lower Chazyan of New York. *Loxoceras moniliforme*, *Cyrtactinoceras boycii*, and *Gonioceras chaziense* make their appearance in the middle Chazyan of New York, while the remaining seven species here listed make their appearance in the upper Chazyan of that state.

There is no known reason why ellipochoanoidal forms should not occur in Canadian or Ozarkian strata. They probably originated in pre-Chazyan times, but it is not known where.

It is well known that various genera here listed as holochoanoidal occur in Chazyan, and even in later strata. Such genera as *Endoceras, Vaginoceras, Cyclendoceras, Cameroceras, Tarphyceras, Deltoceras, Plectoceras, Barrandeoceras, Trocholites,* and *Litoceras* not only occur in Chazyan and later strata, but some of them are unknown in Canadian or earlier horizons. Few of them continue into the Silurian. A species of *Cameroceras,* identified by its peculiar short, obliquely annulated endocone, occurs in the Niagaran of Ekwan River, west of Hudson Bay. A large species of endoceroid, with a holochoanoidal siphuncle, was collected by Per Schei in the Devonian area on the northern half of Goose Fjord, in southwestern Ellesmereland. The latter is to be published under the name *Endoceras schei,* although the structure of the endocones, if present, remains unknown.

Unfortunately the vertical range of the European cephalopods is not known sufficiently well by the writer. *Endoceras vaginatum* Schlotheim, and *Endoceras wahlenbergi* Foord are listed from the *Megalaspis limbata* limestone, which is apparently of Canadian age. *Planctoceras falcatum* Schlotheim occurs in the Kunda formation of the Baltic provinces, correlated by Prof. Raymond with the Cassin formation of Vermont and New York, regarded by Ulrich as also of Canadian age. The *Asaphus platyurus* horizon of the north Baltic area, correlated with the lower Chazyan, contains *Endoceras wahlenbergi* Foord, *Suecoceras barrandei* Dewitz, *Suecoceras recurvum* Holm, *Baltoceras burchardii* Dewitz, *Nanno belemnitiforme* Holm, *Orthoceras conicum* Hisinger, *Orthoceras tortum* Angelin, *Orthoceras scabridum* Angelin, *Rhynchorthoceras angelini* Boll, and *Lituites latus* Angelin. *Discoceras antiquissimum* (Eichwald) is known only from the Lyckholm or Borkholm, or both, strata regarded as approximately of Richmond age. The stratigraphical position of *Falcilituites* is unknown, beyond the fact that it is Ordovician.

16. Silurian species referred to Barrandeoceras

The species originally described as *Gyroceras elrodi* (plate XIII, XIV, XVI) by White, was doubtfully referred by Hyatt[21] to *Barrandeoceras*. However, in the genotype, *Barrandeoceras natator* Billings, the rate of enlargement of the conch in a dorso-ventral direction is much less, and the structure of the siphuncle appears holochoanoidal, while that of *Gyroceras elrodi* is distinctly ellipochoanoidal, only the short septal necks being known, no connecting rings being preserved in the specimens at hand. In this paper, the latter is referred to *Gigantoceras*.

17. Richmond species referred to Litoceras

The species originally described as *Nautilus hercules* by Billings was later referred doubtfully to *Litoceras* by Hyatt.[22] However, in *Litoceras* the cross-section of the conch is much more broadly reniform, the siphuncle is close to the dorsal wall, and its structure is regarded as holochoanoidal, while in the Richmond species named the siphuncle is much nearer the ventral wall, and the structure is distinctly ellipochoanoidal. At present, *Nautilus hercules* is referred to the recently proposed genus *Charactoceras*.[23]

18. Richmond or Black River species referred to Eurystomites

The species originally described as *Eurystomites plicatus* by Whiteaves, presents a broadly reniform cross-section, with the siphuncle distinctly ventrad of the center, and with the segments of the siphuncle distinctly, though moderately, inflated within the camerae. The structure of this siphuncle is distinctly ellipochoanoidal, while that of the genotype *Eurystomites kelloggi* is regarded as holochoanoidal, and the cross-section of the conch of the latter is strongly compressed laterally. The relationship of *Eurystomites plicatus* is with the species originally described as *Nautilus hercules* and with the one described origi-

[21] Loc. cit., 454.
[22] Loc. cit., 480.
[23] Foerste, A. F., Denison Univ. Jour. Sci. Lab., 20, 234 (1924).

nally as *Trochoceras* (?) *baeri* by Meek and Worthen, all three species belonging to the recently proposed genus *Charactoceras*.

19. Silurian species referred to Plectoceras

The species originally described by Whitfield as *Lituites bickmoreanus* (plate XIX, XX) was referred by Hyatt[24] to *Plectoceras*. However, in typical *Plectoceras* the siphuncle is located much nearer the ventral wall of the conch, and its structure appears to be holochoanoidal, while in the Silurian species here named the siphuncle is only slightly ventrad of the center of the conch, the septal necks are short, and no connecting rings are preserved in any specimen examined. The lower part of the septal necks does not curve outward, as in the *Cyrtochoanites*, hence the species is regarded as belonging to the *Orthochoanites*.

20. Silurian species referred to Discoceras

The genotype of *Discoceras* is the species described by Eichwald originally as *Clymenia antiquissima* (plate XVIII, fig. 1), either from the Lyckholm or Borkholm, both of which are regarded as approximately of Richmond age. The species originally described as *Lituites marshii* (plate XXI, figs. 2, 3, 4,) by Hall, from the Niagaran at Kankakee, Illinois, was referred by Grabau and Shimer to *Discoceras*, although the siphuncle of typical *Discoceras* is subdorsan, while that of *Lituites marshi* is slightly ventrad of the center of the conch. The relationship of the latter is with *Lituites bickmoreanus* (plate XIX, XX) both belonging to the generic group *Bickmorites*, proposed in this bulletin.

The species originally described as *Lituites graftonensis* (plate XII, figs. 2, 3) by Meek and Worthen, and that described as *Lituites multicostatus* by Whitfield, were subsequently referred by Hyatt to *Discoceras*, under the single term *Discoceras graftonense*.[25] However, at younger stages of growth in *Discoceras antiquissimum* the cross-section is more quadrangular, and the

[24] Hyatt, Alphaeus, Proc. Amer. Phil. Soc., 32, 500 (1894).
[25] Loc. cit., 501–2.

transverse ribs are bold; while in the Niagaran species named the cross-section is distinctly reniform, and the surface of the shell is marked by much more numerous transverse ribs. For the Niagaran species the generic term *Graftonoceras* is proposed, with *Lituites graftonensis* Meek and Worthen as the genotype.

21. Species referred to Lituites

Numerous species of Canadian, Ordovician, and Silurian age have been referred to *Lituites*, chiefly on account of their tendency toward loose coiling, accentuated in old age by more or less conspicuous unrolling or straightening of the conch, especially of its living chamber, and of the upper part of the phragmacone.

It is well known at present, however, that the chief characteristic of true *Lituites* consists of the presence of deep ventral and dorsal sinuses, shallow lateral sinuses, and intermediate crests. The genotype *Lituites lituus* Montfort occurs in the Platyurus limestone of the Baltic areas, corresponding approximately to the lower Chazyan of American strata, and no true representatives of *Lituites* are known in America. In Bassler's Bibliographic Index only two American species still are referred to *Lituites*, namely *Lituites niagarensis* Spencer and *Lituites pluto* Billings, both only because not sufficient information regarding them is at hand to admit of their reference elsewhere.

Cyclolituites is characterized by a narrow and deep hyponomic sinus, prominent crests on the ventro-lateral angles, lateral sinuses, and probably a dorsal crest. Only one American species has been referred to that genus, namely *Cyclolituites americanus* Hyatt, from the Canadian of Newfoundland.

The *Lituitidae* include the genera *Cyclolituites*, *Lituites*, *Angelinoceras*, *Ancistroceras*, *Rhynchorthoceras*, and *Holmiceras*. All of the typical species occur in strata corresponding to the Canadian and Chazyan of American strata. Two American Silurian species have been referred erroneously to the *Lituitidae*, namely *Ancistroceras dyeri* Hyatt, and *Rhynchorthoceras dubium* Hyatt. The doubtful character of both determinations was recognized by Hyatt, in his original descriptions. Both are discussed in the following notes.

22. Species referred to Ancistroceras

Ancistroceras dyeri Hyatt (plate VI, figs. 1A, 1B), described from the Racine member of the Niagaran at Chicago, Illinois, is related generically to the species originally described as *Lituites hercules* Winchell and Marcy and *Cyrtoceras amplicorne* Hall. It has a large siphuncle, with cylindrical segments, but strongly contracted at the septa, as in the latter species. In this paper the species named are referred to *Uranoceras*.

Typical *Ancistroceras* belongs to the *Lituitidae*. It has a ventral and two lateral sinuses which are distinct, also two minor sinuses on the dorsal side, as in typical *Lituites*, but the crests differ in form from those of the last-named genus. While the earlier formed parts of the conch form a closed spiral for one and a half whorls, the remainder of the conch enlarges at a much more rapid rate than in typical *Lituites*, and even the earlier formed parts of the conch are larger than in the latter genus.

Ancistroceras undulatum Boll, the genotype, occurs in the Chiron limestone of the Baltic areas, and in the overlying *Ancistroceras* limestone, horizons approximately equivalent to the Chazyan.

23. Species referred to Rhynchorthoceras

Rhynchorthoceras dubium Hyatt is identical with the species originally described as *Cyrtoceras indianense* by Miller, from the Laurel member of the Niagaran in Indiana. It has a large siphuncle (plate XXIV, fig. 2), with barrel-shaped segments, both ends of the segments being in contact with the adjacent septa for a considerable width, the opening through the septal neck being much narrower than the area of contact between the ends of the segments of the siphuncle and the septa. The interior of the siphuncle is filled with calcareous deposits as in the *Actinoceratidae*, to which the species in question undoubtedly belongs. *Cyrtoceras indianense* recently has been made the genotype of a new genus, *Elrodoceras*, by Foerste.[25]

Typical *Rhynchorthoceras* is regarded by Hyatt as a degenerate

[25] Foerste, A. F., Denison Univ. Jour. Sci. Lab., 20, 228 (1924).

form of the *Lituitidae*. At the apical end it begins with a cyrtoceran curve, the remainder of the conch being essentially straight and enlarging rapidly. The annuli of the shell have low broad dorsal and ventral crests and shallow lateral lobes. The siphuncle is nearly central in position, and, according to Remele may vary from slightly dorsad to slightly ventrad of the center of the conch. The siphuncle is said to be large.

Rhynchorthoceras angelini Boll occurs in the Platyurus limestone of the Baltic areas, approximately equivalent to the lower Chazyan.

24. Silurian species referred to Nautilus

Typical *Nautilus* was founded on a living species, though Tertiary species also have been assigned to this genus. However, even Canadian, Ordovician, and Silurian species have been included erroneously in *Nautilus*. The Silurian species include the forms originally described as *Lituites cancellatum* McChesney (plates X, XI, XII, XVI, XVII), *Lituites capax* Hall, and *Nautilus oceanus* Hall (plates III, IX, XVII). Of these species, *Lituites cancellatum* is related generically to the form originally described as *Gyroceras elrodi* White (plates XIII, XIV, XVI), and in this paper is referred to *Gigantoceras*. *Lituites capax* may belong to the same species as the form originally described as *Lituites hercules* Winchell and Marcy, which in this paper is referred to *Uranoceras;* however, its identity will always remain in doubt since the type has been lost, and the original description is very inadequate. *Nautilus oceanus* apparently belongs to an unnamed genus distinct both from that including *Lituites cancellatum* and from that including *Lituites hercules*.

25. Silurian species referred to Gyroceras

The genus *Gyroceras* usually is ascribed to DeKoninck, with *Gyroceras paradoxicum* as the genotype. The same species was used later by McCoy as the genotype of *Trigonoceras*. The genus is confined to the Carboniferous, and resembles the earlier forms assigned to it only in the loose coiling of the conch.

The name *Gyroceratites* had been used earlier by v. Meyer[27] for a totally different form, with *Gyroceratites gracilis* as the genotype.

Of the Silurian species referred to *Gyroceras*, only the species *Gyroceras abruptum* Hall (plates XV, XVI), and *Gyroceras elrodi* White (plates XIII, XIV, XVI) are of special interest in connection with the present publication, both apparently being related generically to the species originally described as *Lituites cancellatum* McChesney, and, in the present paper, all are referred to *Gigantoceras*.

26. Silurian species referred to Cyrtoceras

The genotype of *Cyrtoceras* was the species described originally by Goldfuss under *Cyrtoceras depressum* (plate XVIII, fig. 2) Hyatt replaced the name *Cyrtoceras* by *Cranoceras*, using the same genotype,[28] however, in the Zittel-Eastman Text-book of Paleontology he returned to the term *Cyrtoceras*. In the genotype the cross-section of the conch is subtrigonal, with the dorsal side flattened and with the median part of the ventral side subangular. The median part of the flattened dorsal side is slightly convex, and is bordered on each side by a slightly depressed longitudinal zone. The septa, along the upper part of the phragmacone, rise strongly from the dorsal toward the ventral side, producing slight lateral lobes and strongly elevated ventral saddles. The living chamber is very short, and the margin of its aperture rises very strongly from the dorsal toward the ventral side, as is true also of the adjacent septa. The outline of the aperture is T-shaped, but much broader than long. The siphuncle is close to the ventral wall of the conch, its segments are nummuloidal, and its interior is occupied by actiniform vertical lamellae which extend from the walls of the siphuncle inward, but without reaching the center. As far as known, forms of this type occur only in the Devonian.

Almost every imaginable curved cephalopod in which the curvature manifestly does not complete even a single volution

[27] V. Meyer, Act. Nat. Cur., XV, II, 72–74 (1831); Jahrbuch, 482 (1833).

[28] Hyatt, Alphaeus, Proc. Boston Soc. Nat. Hist., 22, 1884, 281.

has been referred at one time or another to the genus *Cyrtoceras*, beginning with Ozarkian and Canadian strata, and extending thence through the Ordovician and Silurian.

Of Silurian species, special attention is called here to the species described by Whiteaves, from the Niagaran at Stonewall, Manitoba, under the name *Cyrtoceras cuneatum* Whiteaves. In general appearance this species is closely similar to a specimen found in the Niagaran at Wabash, Indiana (plate XXI). Both specimens are referred in this bulletin to a new genus, *Oxygonioceras*, though nothing is known definitely of their siphuncles.

Cyrtoceras indianense Miller, from the Laurel member of the Niagaran of Indiana, has been made the genotype of the new genus *Elrodoceras* by Foerste (plate XXIV, fig. 2). Another specimen of the same species was described by Hyatt as *Rhynchorthoceras* (?) *dubium*.

Cyrtoceras laterale is included in the new genus *Amphicyrtoceras*, proposed by Foerste,[29] with *Cyrtoceras orcas* Hall as the genotype. Such forms as *Oncoceras petitti* Billings belong here also. *Streptoceras* Billings is closely related to *Amphicyrtoceras*.

One of the most characteristic features which characterize typical *Cyrtoceras* is the circle of vertical lamellae within the siphuncle which converge toward the center in an actiniform manner. This form of structure is known at present from American Ordovician cyrtoceraconic species only from *Cyrtoceras conoidale* Wetherby and *Cyrtoceras vallandighami* Miller, neither of which are typical species of *Cyrtoceras*. If any other American Ordovician species is known to have this structure, this information is very much desired.

27. Barrande species with actiniform siphuncles

It is evident that Hyatt made a prolonged study of the cephalopods described by Barrande from central Bohemia, and founded many of his genera on Barrande's species. His grouping of numerous genera under a division of the *Cyrtochoanites* known as

[29] This Journal, 20, 255 (1921).

the *Actinosiphonota* (Zittel-Eastman Text-book of Paleontology) probably was largely based on species figured by Barrande. Hence it is of interest to learn what species, among those figured, have this structure. The following list includes those noted, no change being made here from the Barrande nomenclature. In this list the letters following the names of the species indicate the horizons, according to the Barrande system. *G* indicates Devonian. According to J. Perner, the dividing line between the lower Devonian and upper Silurian lies near the middle of division *F*. Division *E* extends from the Llandovery to the upper Ludlow members of the Silurian. Division *D* is of Ordovician age. The numbers following the division letters indicate the plates in Barrande's great work on the cephalopods on which the species named are illustrated.

Actinosiphonata

Adelphoceras bohemicum...G 457
Cyrtoceras abditum.....E 480
archiaci.....E 480
danai.....E 171
desolatum.....E 513
indomitum.....E 162
laetificans.....G 468
lumbosum.....G 470
palinurus.....G 466
penultimum.....E 470
solitarium.....E 155
strangulatum...E 512
turnus.....G 484
Gomphoceras gratum..E 82, 491
loveni.....E 99
pollens.....E 85
Nothoceras bohemicum.....G 13
Orthoceras archiaci.....G 251
bonum.....D 247
exile.....E 131
infelix.....E 525
jovellani.....G 254
victor.....G 353
Phragmoceras baro.....G 454
bolli.....G 454
callistoma...E 47
clypeatum...G 538
comes G 63, 455, 491
conradi.....E 49
devonicus....G 107
discrepans...E 49, 51, 492
empiricum...G 541
globulosum..E 52
hospes.....G 543
infaustum...E 55
inflexum.....G 540
insolitum....E 52
loveni.....E 49
panderi..E 50, 148
pavidum.....E 51
princeps.....G 457
problematicum E 54
rex.....G 62
rigescens.....G 520
verneuili....G 66
vetus.....E 54
Trochoceras lorierei..... 460

Of these species, *Cyrtoceras desolatum* is the genotype of *Mixosiphonoceras* Hyatt; *Cyrtoceras indomitum* is the genotype of *Codoceras* Hyatt; *Orthoceras archiaci* is the genotype of *Tripleuroceras* Hyatt; *Orthoceras jovellani* belongs to the genus *Jovellania* Bayle, but is not the genotype; *Phragmoceras callistoma* is the genotype of *Octameroceras* Hyatt; and *Phragmoceras panderi* is the genotype of *Hexameroceras* Hyatt.

Typical *Cyrtoceras* has the same actiniform arrangement of vertical lamellae, as already noted.

It is evident that Hyatt placed under the *Actinosiphonata* a considerable number of genera in which no actiniform arrangement of vertical lamellae is to be found within the siphuncle, the relationship of which to the *Actinosiphonata* may be regarded as extremely doubtful.

Eremoceras and *Cyclostomiceras* are regarded here as holochoanitic in structure, as previously stated. No actiniform siphuncles are known in *Rizoceras*, *Cyrtorizoceras*, *Ooceras*, *Oncoceras*, *Meloceras*, or *Clinoceras*, and in typical forms of these genera the siphuncle is only moderately enlarged within the camerae, and never is nummuloidal. In *Poterioceras* McCoy the segments of the siphuncle are oval or globular rather than nummuloidal. In *Streptoceras* Billings the segments are cylindrical, but strongly and abruptly contracted at the septa, as in *Amphicyrtoceras* Foerste.

28. Annulosiphonata

Those species of *Cyrtochoanites* in which the calcareous deposits within the siphuncle start as annular rings encrusting the inner walls of the short septal funnels were grouped by Hyatt under the term *Annulosiphonata*. In transverse vertical sections these deposits appear to enclose the funnels or necks in a more or less lunate manner. With increased growth the lunulations encroach more and more on the space left in the interior of the siphuncle, leaving finally an irregular central passage or endosiphuncle. Successive lunulations meet near or above midheight of the intermediate camerae, so-called tubuli radiating in some specimens from the endosiphuncle, along the plane of

contact between successive lunulations, toward the exterior parts of the camerae. This form of structure characterizes the *Actinoceratidae*.

29. **Loxoceras** M'Coy

Loxoceras was described by M'Coy[30] as including Orthoceroids "in which the section is oval, the septa waved and placed obliquely with respect to the axis of the shell, and the siphuncle is excentric."

Four species are described under the name *Loxoceras* in alphabetical order:[31] *Orthoceras* (*Loxoceras*) *Breynii* Martin, *Orthoceras* (*Loxoceras*) *distans* M'Coy, *Orthoceras* (*Loxoceras*) *incomitatum* M'Coy, and *Orthoceras* (*Loxoceras*) *laterale* Phillips.

Of these 4 species only *Orthoceras distans* M'Coy and *Orthoceras incomitatum* M'Coy are figured on the accompanying plates, and of these two only *Orthoceras distans* resembles in the sinuous direction of its sutures the diagrammatic figure of the conch accompanying the original description of the genus[32] differing from the latter in its more distant septa. Its siphuncle, moreover, is central.

Orthoceras laterale Phillips, the fourth species in the series described by M'Coy, is first mentioned in Illustrations of the Geology of Yorkshire, Pt. II, in 1836, on page 251, in connection with figure 8 on plate 21, which bears no resemblance to the figure of *Orthoceras distans* presented by M'Coy. However, in the Figures and Descriptions of the Palaeozoic Fossils of Cornwall, Devon, and West Somerset, published by Phillips in 1841 (p. 110, pl. 41, fig. 205 a-e), two specimens are figured of which the first (f. 205 a, b) presents an appearance closely similar to that of the diagrammatic figure accompanying the original description of the genus *Loxoceras* (p. 6, fig. 3, left figure); however, the siphuncle is central, or nearly central.

The present writer regards *Loxoceras distans* M'Coy as the most logical specimen to select for the genotype of *Loxoceras*,

[30] M'Coy, Synopsis of the Characters of the Carboniferous Limestone Fossils of Ireland, 6, fig 3 (1844).

[31] Loc. cit., 8–9.

[32] Loc. cit., 6, fig. 3, left figure.

however, *Orthoceras breynii* usually is selected, since it is the first species published by M'Coy under this name. The latter species was described by Martin in the Petrefacta derbiensis, in 1809, and is there represented by figure 4 on plate 39. Owing to the quite general misunderstanding of the limits of the genus *Loxoceras*, the following description of the *Orthoceras breyni* by Sedgwick will prove of interest.

30. **Orthoceras** (**Loxoceras**) **breyni** (Mart. sp.)

Plate IX, fig. 2

From "A Synopsis of the Classification of the British Palaeozoic Rocks," by Rev. Adam Sedgwick, 1854, p. 567.

Rapidly tapering (at an angle of about 14°): moderately depressed, section broad-oval. Septa from last chamber, to four lines in diameter, averaging five or six in the space equal to a diameter; very slightly oblique on the narrow sides, slightly higher or more anterior on one of the broad sides, which they cross with a scarcely perceptible wave towards the mouth; a little lower or more posterior on the other broad-side, in the middle of which is a strong backward wave, near to which the siphuncle is placed on the conjugate axis. Siphuncle small, and a little within the margin, where it passes through the septa, but dilated between them into depressed spheroidal beads, about twice as wide as long, and touching the surface throughout the length of the shell; interior of the siphon traversed by a small continuous tube, attached to the inner walls of the dilated portion by radiating, vertical, shelly partitions (about eight in a whorl), constricted by transverse stronger partitions in the middle of each dilation (or intermediate between the septa). Surface (indistinct) apparently marked with fine, obtuse, transverse striae. The proportion of the long and short diameter of the section is as 100 to 85. A specimen five inches long is one inch three lines wide at the large end, and two lines wide at the apex, the dilated part of the siphon at the latter point equalling the whole diameter of the shell, but being only five lines wide at the anterior end, where two chambers occupy a space of slightly less than half an inch, while six chambers occupy the same space at the small end.

The internal structure of the siphon is that of *Actinoceras* of Stokes, though it is marginal in position, and the septa are oblique. Sowerby's

figure under this name has the septa too oblique and too close to agree accurately with the species.

Position and locality.—Very common in the red carboniferous limestone of Closeburn, Dumfriesshire; rare in the dark carboniferous limestone of Isle of Man; common in the black beds overlying the main carboniferous limestone in Derbyshire, more rare in the underlying white beds; not uncommon in the dark carboniferous limestone of Lowick, Northumberland.

Judging solely from the published figure and descriptions, the species *Loxoceras breynii* does not belong to the same genus as *Loxoceras distans*. The conch of the former is depressed dorsoventrally, its siphuncle is located close to the ventral wall, and the interior of the siphuncle is filled with Actinoceroid calcareous deposits. The conch of the latter is compressed laterally, the siphuncle is subcentral in location, and nothing is known of the structure of the interior of this siphuncle. For additional information see this Journal, vol. 20, page 226 (1924).

31. **Cycloceras** M'Coy

Cycloceras was described by M'Coy[33] as including "those conical species marked with prominent concentric rings, and having the surface frequently sculptured with transverse scaly laminae, and often decussated; siphuncle dorsal." M'Coy's figure is copied, enlarged, on plate XI (figs. 3A, 3B) of this Journal.

Four pages later three species are described under the name *Cycloceras*, namely *Cycloceras annulare* Fleming, *Cycloceras laevigatum* M'Coy, and *Cycloceras lineolatum* Phillips. None of these three species has the vertical lines presented by the diagrammatic figure accompanying the original description of *Cycloceras*; and, therefore, none of these three species can be considered as genotypes of *Cycloceras*, if the diagrammatic figure is to be regarded as diagnostic.

The species described and figured by Phillips as *Orthoceras rugosum* Fleming, however, could have been used in preparing

[33] Loc. cit., 6, fig. 6.

M'Coy's diagrammatic figure, and is either the original genotype, or a closely related species. This species is described by Phillips[34] as follows: "Northumberland. Subcylindrical (or suddenly tapering), with annular waved rather distant ridges, tuberculated by many longitudinal echinated lines." Phillips's figure is copied on plate XI (fig. 2) of this Journal.

In the Annals of Philosophy, vol. 5, 1815, p. 203 (plate 31, fig. 9), the following description is given:

> Shell, subcylindrical; ridges, waved and tuberculated, with longitudinal lines; pipe (siphuncle), minute and lateral. The length of this specimen is upwards of an inch and a quarter, and the breadth about six-tenths. The ridges are formed into knobs by faint longitudinal lines, which cause the intermediate spaces to exhibit a grooved appearance; they are upwards of two-tenths of an inch asunder, and contain two chambers in the interval; the pipe is very small, and placed close by the edge. For additional information see this Journal, vol. 20, page 222 (1924).

32. **Uranoceras** Hyatt

Plate I, figs. 2A, 2B; plate IV, figs. 2A, 2B; plate VII, fig. 3

Uranoceras Hyatt. Proc. Boston Soc. Nat. Hist., 22, 1884, p. 298; Proc. Am. Phil. Soc., 32, 1894, p. 529.

Genotype.—*Cyrtoceras Uranum* Barrande, Systeme Silurien de la Boheme, 2, pl. 196.

The genotype of *Uranoceras* is represented by fragments having a cyrtoceroid aspect, but the complete conch must have included almost an entire volution, having a loosely gyroceran, rather than nautiloid, form. The umbilical opening is very large. The conch is compressed laterally, the ventral and dorsal sides are approximately of the same width, and the cross-section tends to be quadrangular. The sutures of the septa have shallow lateral lobes and low but broad ventral and dorsal saddles. The siphuncle is located a short distance ventral of the center of the conch. The segments of the siphuncle tend to be cylindrical within the camerae, but are strongly contracted at the septa.

[34] Phillips, Geology of Yorkshire: pl. XXI, fig. 16 (1836).

The septal necks are funnel-shaped, and their lower margins project downward into the interior of the upper part of those segments of the siphuncle which are located immediately beneath. The upper margins of the connecting rings come in contact with the septal necks along a circular line located distinctly exterior and above the lower margin of these necks. On the ventral side of the siphuncle, the lower margin of the segments is more or less adnate to the adjacent part of the septum beneath, while the upper margin of the underlying segment is distinctly distant from this septum. No calcareous deposits, either Actinoceroid or actiniform, occur within the siphuncle. From Tachlovitz, Bohemia, in the Silurian.

The structure of the siphuncle is similar to that of *Amphicyrtoceras, Streptoceras, and Monocyrtoceras.* See also Foerste, A. F., this Jour. 20, 259 (1924).

33. **Uranoceras hercules** (Winchell and Marcy)

Plate I, fig. 1; plate II, fig. 1; plate III, fig. 1; plate IV, fig. 1; plate VII, fig. 2; plate VIII, figs. 1-4; plate XVI, fig. 4

Lituites Hercules Winchell and Marcy, Mem. Boston Soc. Nat. Hist., 1, 1865, p. 102, pl. 3, fig. 9.

Lituites capax Hall, Rep. Progress Geol. Surv. Wisconsin, 1860, p. 3.

Nautilus capax Hall, 20th Rep. New York State Cab. Nat. Hist. 1868, p. 363; rev. ed., 1870, p. 400.

Cyrtoceras (*Phragmoceras*?) *amplicorne* Hall, 20th Rep. New York State Cab. Nat. Hist., 1868, p. 358; pl. 17, figs. 6. 7; p. 393.

Original description of *Lituites Hercules* (but with the terms *ventral* and *dorsal* interchanged so as to conform with present terminology):

Shell very large, apparently forming less than a complete whorl in any of the specimens seen. Venter and sides flattened-convex—the latter less flattened than the venter. Septa moderately concave, plane, much flatter in the middle than around the margins; siphon rather small, central. Greatest transverse diameter three-fourths the distance from the ventral to the dorsal side, causing the lateral sur-

faces to approximate ventrally. Surface ornamented only by encircling striae which at intervals aggregate into irregular undulations. The striae curve backwards on the sides and make a further deep retral sinus across the venter. Ventro-dorsal diameter, 4.25 inches; transverse diameter, 4.12; diameter of siphon, 0.22; depth of ventral sinus of the striae, about one inch. The diameter of the shell from the mouth to the opposite side was from seven to nine inches. One of our specimens is an impression of the shell in the rock. This shows that the apex of the whorl presented an obtuse termination more than an inch in diameter.

The type was found at Bridgeport, a suburb in the southern part of Chicago, Illinois. The figure accompanying the original description is half of the natural size. Regarding this figured specimen Winchell and Marcy state that it is not one of the typical specimens, and that there is even some doubt of its specific relationship.

Remarks.—The conch of this species, as far as known, always is gyroceran. The figured specimen apparently was comparable in size with specimen No. 25851, in the U. S. National Museum, represented by figure 1 on plate II in this Journal though in that specimen the dorso-ventral diameter of the upper part of the living chamber may have been shortened possibly 10 mm. by cutting away too much of the matrix along the dorsal side of the living chamber. Specimen No. 27938, in the U. S. National Museum, illustrated by figure 1 on plate I, probably gives a much better representation of the more usual rate of enlargement of this chamber. The apical end of the conch is not preserved in any of the specimens examined, but the rate of tapering of the conch, at its smaller end, suggests that complete conchs usually included about one and a half volutions, surrounding at the center an umbilical opening which usually varied from 20 to 30 mm. in diameter. Possibly the number of volutions and the size of the umbilical opening were variable. At least, in the specimen described by Hall as *Cyrtoceras amplicorne* (plate V, fig. 1), the conch appears to have been somewhat shorter, and the umbilical opening was fully 50 mm. in diameter. In the specimen described by Hyatt as *Ancistroceras dyeri* (plate VI, figs. 1A, 1B;

pl. VII, fig. 1) the conch included apparently about two-thirds of a volution, and the umbilical opening was also about 50 mm. in diameter. Whether the specimens with the larger unbilicus constitute a distinct species can not be determined with confidence from the meager material at hand.

In the more typical forms of *Lituites hercules* the whorl is wider dorsad of the center of the conch, but in the specimen described as *Cyrtoceras amplicorne* the larger lateral diameter is at the center. According to Winchell and Marcy, the ratio of the lateral diameter to the dorso-ventral one is 97 hundredths, but in the specimens examined by the writer it varies from 82 to 90 hundredths, except in the case of *Cyrtoceras amplicorne,* in which it appears to equal only 78 hundredths.

The location and structure of the siphuncle appear to be similar to that of the genotype of *Uranoceras* (plate VIII, fig. 1A).

Waukesha specimen.—Specimen No. 22971 (plate XVI, fig. 4) at the University of Chicago was obtained from the Niagaran at Waukesha, about 18 miles southwest of Milwaukee. The specimen consists of a living chamber with 4 camerae still attached. The 4 camerae occupy a total length of 100 mm., measured along the ventral side. The dorso-ventral diameter enlarges from 55 mm. at the base of the specimen to 75 mm. at the base of the living chamber and to 100 mm. at a point 150 mm. above the base of this chamber. There is not the slightest trace of contact between the dorsal side of this specimen and the ventral side of the now missing preceding volution. The ratio of the lateral diameter to the dorso-ventral one varies from 80 per cent along the upper part of the phragmacone to 77 per cent along the upper part of the living chamber. The sides tend to be flattened and they converge distinctly from the dorsal toward the ventral side. The 4 camerae occupy a length equal to the dorso-ventral diameter of the conch. The sutures of the septa have very broad and shallow lobes, 2 or 3 mm. in depth. Along the ventral side of the conch the sutures are directly transverse or faintly depressed along their median parts. No trace of the siphuncle is present. No part of the surface of the shell is preserved, but faint traces of undulations of growth on the cast

of the interior of the living chamber indicate that this surface was striated transversely, the striations curving strongly downward ventrally, as in *Lituites hercules* Winchell and Marcy.

Nautilus capax Hall. In the 20th Report of the New York State Cabinet of Natural History, 1868, page 363, the following description is published.

> This species (*Nautilus capax*) differs from *N. occidentalis* in its more rotund form, the section of the outer volution being very broadly elliptical or nearly circular, and showing rapid expansion towards the aperture.
>
> *Formation and locality.* In limestone of Niagara age, at Waukesha and Racine, Wisconsin.

Nautilus occidentalis was identified by Hall himself with *Lituites cancellatum* McChesney. The description of *Nautilus capax* is not sufficient for identification of the species. Apparently it is identical with *Lituites hercules*, but the type of *Nautilus capax* has been lost and the name should give way in any event to *Lituites hercules*, which was adequately figured and described.

Cyrtoceras (*Phragmoceras*?) *amplicorne* Hall. The type specimen (plate V, fig. 1; plate VIII, fig. 2) consists of a phragmacone with the lower part of the living chamber still attached. Of the phragmacone, 14 camerae are defined distinctly by the sutures. The entire conch exceeded one volution in length; its coiling was gyroceran rather than nautilian, and the umbilical opening was about 50 mm. in diameter. The rate of enlargement of the conch dorso-ventrally is at an apical angle of about 14 degrees. The corresponding lateral angle varies from 13 degrees along the smaller end of the specimen to 10 degrees along its larger end. Including the living chamber, this type specimen may have attained a maximum diameter of 225 mm. across the umbilicus.

At the base of the living chamber, the dorso-ventral diameter is 68 mm., and the lateral diameter is 56 mm. The conch is slightly broader on the ventral than on the dorsal side, but not sufficiently broader to be readily noticeable. Compared with the dorsal and ventral sides, the lateral sides are so much less convex as to appear more or less flattened.

Toward the base of the specimen, 4 camerae occupy a length equal to the dorso-ventral diameter of the conch at the top of the series of camerae counted, but toward the top of the specimen 5 camerae occupy the same length. The uppermost camera is distinctly shorter than the adjacent ones, indicating that the conch had reached full maturity.

The sutures of the septa have very shallow lateral lobes, not exceeding 2 mm. in depth; the dorsal and ventral saddles are correspondingly low. At its passage through the septum at the base of the specimen, the center of the siphuncle is 15 mm. from the dorsal wall and 14 mm. from the ventral wall of the conch. A very short septal funnel, 1.5 mm. in diameter, projects in an apicad direction. Nothing is known of the connecting rings, between the successive septal funnels.

Locality and Horizon.—From the Racine dolomite at Waukesha, Wisconsin. Type, numbered 2124, in the American Museum of Natural History.

Remarks.—In the revised edition of the 20th Report of the New York State Cabinet of Natural History, published in 1870, Hall referred his species *Cyrtoceras amplicorne* to *Lituites hercules* of Winchell and Marcy, using the generic designation *Cyrtoceras*. However, it appears to be a more loosely coiled form than typical *Lituites hercules*, with a much larger umbilical opening, and the length of the conch appears to be less, only moderately exceeding one volution. Hence there is a possibility of *Cyrtoceras amplicorne* being distinct from typical *Lituites hercules*, though belonging to the same genus, namely *Uranoceras*.

34. **Uranoceras dyeri** (Hyatt)

Plate VI, figs. 1A, 1B; plate VII, fig. 1

Ancistroceras ? *dyeri* Hyatt, Proc. Amer. Phil. Soc., 32, 1894, p. 511.

Type specimen.—The specimen originally described as *Ancistroceras dyeri* appears to belong to the same generic group as *Lituites hercules* and *Cyrtoceras amplicorne*. It has the same tendency toward a quadrangular cross-section, narrower ven-

trally. The sutures of the septa follow a similar course, and the siphuncle is located in a similar manner slightly ventrad from the center of the conch. The transverse striae outline a hyponomic sinus of similar depth. The slightly sinuous path of these transverse lines along the lateral sides of the surface of the shell appears to be a gerontic feature occurring also at similar stages of growth in typical specimens of *Lituites hercules*. *Ancistroceras dyeri* differs from the latter chiefly in its more rapid rate of increase in diameter, both dorso-ventrally and laterally. The conch is shorter, completing about two-thirds of a volution. In this respect *Cyrtoceras amplicorne* appears intermediate between typical *Lituites hercules* and *Ancistroceras dyeri*. The camerae are about as numerous as in the specimen of *Lituites hercules* figured on plate I of this bulletin.

The following is the original description:

Sutures with slight broad ventral lobes, slight saddles at the abdominal angles, lateral lobes, saddles at the umbilical shoulders, and apparently narrow dorsal lobes. The fragment is that of a rapidly enlarging arcuate whorl, subquadragonal in section, the lateral zones slightly convergent outwards, the dorsum broader than the venter. The siphuncle is ventrocentren. The lines of growth seen on the living chamber had the characteristic ventral sinus, slight crests on the abdominal angles, slight lateral sinuses, broad low crests on the umbilical shoulders and internally faint minor dorsal sinuses apparently rising to an equally faint median dorsal saddle. It has been named *Cyrtoceras amplicorne*, Hall, and closely resembles that species, but the section is more decidedly quadragonal, the sides and the venter flatter and the transverse diameter broader.

Locality and horizon.—From the Racine dolomite near Chicago, Illinois.

Specimen No. 2134, Museum of Comparative Zoology, at Harvard University.

Remarks.—If *Ancistroceras* Boll and *Rhynchorthoceras* Remele belong to the true Lituitidae, as usually is assumed, then the specimen described by Hyatt as *Ancistroceras dyeri* is not closely related to either genus. On the contrary, its relationship appears to be with the group typified by *Lituites hercules*, and here referred to the genus *Uranoceras*.

35. "Nautilus" oceanus Hall

Plate III, fig. 2; plate IX, fig. 1; plate XVII, fig. 1

Nautilus Oceanus Hall, 11th Ann. Rep. Indiana Dep. Geol. Nat. Hist., 1882, p. 325.

Type specimen.—Large fragment, consisting of the lower half of the living chamber with 8 camerae still attached. Of these, the uppermost camera is considerably shorter than the rest, indicating that the conch had reached maturity. The conch is strongly curved lengthwise in a dorso-ventral direction. The convex curvature of the ventral side has a radius of 130 mm. along the phragmacone, changing to 150 mm. along the lower part of the living chamber. The corresponding concave curvature of the dorsal side varies from a radius of 45 mm. along the phragmacone to a smaller curvature along the living chamber. The dorso-ventral diameter is 62 mm. at the base of the specimen, and 105 mm. at the base of the living chamber, the interval, measured along the central axis of the conch, being 125 mm. The lateral diameter at corresponding points is estimated at 53 mm. and 73 mm. respectively, as far as can be determined from the transverse curvature of the parts preserved. Of the living chamber only a length of 130 mm. remains, but its original length may have been twice as great. The conch is compressed laterally and flattened ventrally, resulting in ventro-lateral shoulders which, however, are rather broadly rounded, rather than angular. The entire conch may have had a maximum diameter of 300 mm. across the umbilical opening.

Counting along the ventral side of the conch, slightly less than 4 camerae occur in a length equal to the dorso-ventral diameter of the conch. The sutures of the septa have relatively deep lateral and ventral lobes and correspondingly conspicuous ventro-lateral saddles. The depth of the lobes mentioned equals 10 mm., the intervening saddles being more conspicuous than in any other species known either from the Laurel or the Racine formations. The sutures rise strongly toward the dorsal side of the conch, apparently resulting in a single saddle there. There is no trace of the siphuncle.

Locality and Horizon.—From Flat Rock creek, in Shelby county, Indiana, possibly from some point southwest of St. Paul. From the top of the Laurel member of the Niagaran.

Specimen No. 12329, in the New York State Museum at Albany, New York.

Original description by Hall.—

> Shell large, discoidal; volutions closely coiled but not reentrant; umbilicus large and open; transverse section elliptical, the dorso-ventral diameter being the greater. Shell gradually enlarging. Chamber of habitation large; length twice the greater diameter, the capacity being equal to, or greater than, the entire septate portion of the shell; becoming straight, and free from the inner volutions, toward the aperture. Septa regular, two in the space of five centimeters on the ventrum, and five in the same space on the dorsum. The specimens measure from twenty to twenty-five centimeters in diameter. This species resembles *N. occidentalis* of the Niagara group of Wisconsin, but the form is less gibbous and the septa less distant than in that species.

Remarks.—This original description by Hall suggests to the present writer not the type specimen, described in the preceding lines, but the form described by C. A. White, in the same volume, and from the same geological horizon, as *Gyroceras elrodi*. It seems incredible that Hall should have failed to note in his original description the strongly flattened venter of the conch, and the well defined ventral lobes of the sutures, if this Flat Rock specimen was his type. Nevertheless, at the time of examination of this specimen by the present writer it bore the label *Nautilus Oceanus* in Hall's handwriting, still attached to the specimen, and therefore it must stand as the type, regardless of the inadequate, and somewhat misleading description. Apparently Hall had some of the specimens of *Gyroceras elrodi* in mind, in preparing his description, not having discriminated the same from *Nautilus oceanus* as yet.

Generic relations.—The species described by Hall as *Nautilus Oceanus* evidently does not belong to *Nautilus* in its restricted sense. Judging from the strongly flattened ventral side and the deep ventral lobes of the sutures, it does not belong to *Uranoceras*.

Apparently it belongs to an undescribed genus, strongly compressed laterally, with the venter broader than the dorsum. While the venter is distinctly flattened, the dorsum is more narrowly rounded. The lateral sides are broad and moderately rounded, in contrast with the more rapidly rounded dorsal and ventro-lateral parts of the outline. The deep ventral lobes and correspondingly prominent ventro-lateral saddles have been mentioned already. Unfortunately nothing is known of the siphuncle, not even its location, and without this knowledge it does not seem advisable to propose a new generic name for the species in question.

36. **Gigantoceras** Hyatt

Gigantoceras was defined in the Zittel-Eastman Text-book of Paleontology in the following terms:

> Gryoceracones similar to the preceding (*Uranoceras*), but having longer living chambers and more compressed volutions. Includes the largest known Nautiloid shells. Type *G.* (*Gyroceras*) *inelegans* (Meek). Silurian.

The species described by Meek as *Gyroceras* (*Nautilus* ?) *inelegans* (Proc. Acad. Nat. Sci., Philadelphia, 1871, p. 89) was redescribed in the Paleontology of Ohio, vol. I, p. 232, 1873, and figured on the accompanying plate 21. This genotype is not from the Silurian, but from the Columbus or Onondaga limestone of Marion county, Ohio. Hyatt apparently had a group of Silurian species in mind when writing his description, but selected a Devonian species in naming his type. The Silurian species probably were those described originally as *Lituites cancellatum* McChesney and *Gyroceras elrodi* White.

In a specimen of *Gyroceras inelegans* in the U. S. National Museum the ratio of the lateral diameter of the whorl to the dorso-ventral one averages about 85 per cent. The maximum diameter of the conch is at least 240 mm. across the umbilical part. At the larger end of the specimen, the aperture not being retained, the dorso-ventral diameter is 112 mm., and the lateral diameter is estimated at 96 mm. At the base of the living

chamber the dorso-ventral diameter is 88 mm., and the lateral one is estimated at 75 mm. Where the dorso-ventral diameter is 38 mm., the lateral one is estimated at 32 mm. The distance between the last two points of measurement, along the curving central axis of the whorl, is 195 mm. The rate of enlargement of the conch is about 15 degrees dorso-ventrally and about 12 or 13 degrees laterally. Notwithstanding the small difference in the dorso-ventral and lateral diameters, the conch appears strongly compressed laterally, since the lateral sides are much less convex than the dorsal or ventral ones, the ventral side showing the greatest curvature.

No evidence can be discovered that the later volutions embraced the earlier ones even slightly. As far as known, the dorsal side of the conch is not impressed, even where it is nearest the ventral side of the preceding whorl, the latter having a dorso-ventral diameter of 30 mm.

According to Meek the "surface of the cast sometimes shows on the inner volutions some very faint traces of rather distant transverse ridges, which become nearly or quite obsolete on the outer turn."

The sutures of the septa have shallow lateral lobes and low dorsal and ventral saddles. The siphuncle is located slightly ventrad of the center of the cross-section of the whorl. Only the short septal funnels are known, no trace of the connecting rings being preserved in the specimen examined. The lower margin of the septal funnels curves downward, but not outward as in the typical *Cyrtochoanites*.

37. **Gigantoceras cancellatum** (McChesney)

Plate X, fig. 1; plate XI, fig. 1; plate XII, fig. 1; plate XVI, fig. 2; plate XVII, figs. 2, 3, 4

Cyrtoceras giganteum McChesney, Desc. New Species Fossils, 1869, p. 67.

Lituites cancellatum McChesney, Desc. New Fossils, 1861, p. 96; Plates Illustr. New Species Fossils, 1865, pl. 7, fig. 8; Trans. Chicago Acad. Sci., 1, 1868, p. 51, pl. 7, fig. 8.

Lituites occidentalis Hall, Rep. Progress Geol. Surv. Wisconsin, 1861.

Nautilus occidentalis Hall, 20th Rep. New York State Cab. Nat. Hist., 1868, p. 363; rev. ed., 1870, p. 400.

Lituites cancellatus; description by McChesney, with the terms dorsum and venter interchanged, to conform with present terminology:

Shell very large, discoidal or nearly so. Volutions two, contiguous, and sometimes with the dorsal side slightly compressed by the venter of the preceding volution, rapidly expanding; section strongly elliptical, the dorso-ventral diameter being much greater than the lateral; septa convex, distant one inch measured on the side near the outer chamber; umbilicus broad and shallow; the spire in some specimens appears to be slightly more depressed on one side than on the other; siphuncle comparatively small and nearly central. The outer or produced portion of the last volution is nearly straight, and, when perfect, is extended so as to render the form of the shell somewhat elongate; mouth unknown. Surface, of perfect specimens, beautifully cancellated by low, rounded, transverse, rib-like striae, which curve back on the venter, and number eight or nine to the inch on the middle of the outer volution, and by fine revolving striae, four or five of which measure a line (a twelfth of an inch). The greatest diameter of the specimen under description is about twelve inches, and the diameter at right angles to it, ten inches. It should be compared with *L. capax* and *L. occidentalis* of Hall, to which it is closely allied. *Geological position and locality.* In the Niagara division of the Upper Silurian rocks at Joliet, Illinois.

Additional Joliet specimens.—Specimen 22968 (plate X, fig. 1; plate XVI, fig. 2; plate XVII, fig. 2), at the University of Chicago, consists of the phragmacone and the lower quarter or third of the living chamber. Greatest diameter across the umbilical opening, 240 mm.; original diameter of complete specimen probably 300 mm. or more. About 40 mm. above the uppermost distinct outlined suture there is a faint indication of another septum. The dorso-ventral diameter of the whorl at the uppermost distinct suture is 107 mm., the lateral diameter being estimated at 55 mm. Even after making allowance for possible

flattening during fossilization, the specimen originally must have been strongly compressed laterally. Four camerae or 110 mm. farther down, measured along the central axis of the conch, the dorso-ventral diameter is 70 mm., and the lateral diameter is estimated at about 50 mm. Four additional camerae, or 79 mm., farther down the corresponding measurements are 44 mm. and 30 mm. Four camerae, or 47 mm., farther down, they are 26 mm. and 18 mm. Finally, four additional camerae, or 35 mm. farther down, the dorso-ventral diameter is 16 mm. These measurements suggest an apical angle of 19 degrees dorso-ventrally, and of 16 degrees laterally, along the lower part of the conch, the lateral angle diminishing farther up. The ratio of the lateral diameter to the dorso-ventral one diminished from 70 per cent along the lower part of the phragmacone to 55 per cent along the lower part of the living chamber, owing to increased lateral compression of the conch.

A short distance above the base of the living chamber, the dorsal side of this chamber evidently was in contact with the ventral side of the preceding volution, but nearer the apical angle of the specimen this interval increases to 4 or 5 mm. There evidently was an umbilical opening, possibly 15 mm. in diameter, but its exact size is unknown.

Viewed from the ventral side, the conch appears strongly compressed laterally. At all stages of growth, the ventral side is more strongly convex transversely than the dorsal side. The lateral sides are least convex, there being a tendency toward flattening, with a moderate convergence from the dorsal toward the ventral side of the conch.

The number of camerae in a length equal to the dorso-ventral diameter of the conch tends to be about 3 along the greater part of the phragmacone, when measured along the central axis of the conch, increasing to 4 at the top of the phragmacone. The sutures of the septa have very broad and shallow lobes, usually not over 2 or 3 mm. in depth; the ventral and dorsal saddles are correspondingly low. Owing to the rather strong transverse convexity of the ventral side of the conch, the ventral saddles from this point of view appear narrower and more

strongly elevated. Toward the dorsal side of the conch the sutures curve downward sufficiently to cross the latter in an almost directly transverse direction.

Where the dorso-ventral diameter is 90 mm., a break across the specimen reveals the short septal funnel at a point about half-way between the dorsal and ventral sides of the conch; however, owing to the rise of the septa to a moderately greater height on the ventral side than on the dorsal one, this septal funnel appears to be distinctly nearer the dorsal side than the ventral one, when measured along the septa, in the ratio of 5 to 7. Where the septum begins to be depressed at the top of the septal funnel, the dorso-ventral diameter of this depression is about 10 mm.; decreasing to 6 mm. at the lower margin of the funnel. The length of the funnel is scarcely 2 mm. Nothing is known of the rings connecting successive septal necks.

No part of the surface of the shell is preserved, but, toward the apical end, the cast of the interior of the phragmacone is crossed by transverse plications or ribs which curve strongly downward toward the ventral side, and which, no doubt, indicate the direction of the surface striae. Where the dorso-ventral diameter of the conch is 13 mm., 5 of these transverse plications occur in a length of 10 mm. Above this point the plications become lower, are more widely spaced, and disappear within 1 or 2 centimeters.

In a second specimen from the same locality (plate XII, fig. 1; plate XVII, fig. 3), No. 22028 at the University of Chicago, the apical end of the conch may be traced down to a point where its diameter is scarcely 5 mm. Here the cross-section appears to be circular, and it apparently remains nearly circular until a diamter of 15 mm. is attained. Above this point the conch becomes more and more distinctly compressed laterally, as stated above. The oblique transverse plications here again are confined to the apical end of the specimen; however, they are very faint and rather more widely spaced than in the preceding specimen, though still distinguishable. In this specimen only the apical end of the conch could have been in contact with any later formed portion of the shell.

Bridgeport specimen.—In a third specimen (plate XI, fig. 1; plate XVII, fig. 4), No. 22863 at the University of Chicago, labelled as coming from Bridgeport, Illinois, a suburb in the southern part of Chicago, but in a rock much resembling that found at Joliet, the oblique transverse plications, along the more apical part of the specimen, occur at the rate of 5 in a length of 10 mm. up to a point where the dorso-ventral diameter of the conch is 10 mm.; the next 5 plications, farther up, occupy a length of 13 or 14 mm.; and the next 5, of about 17 mm., the last set tending to be so low and faint as not to be recognizable readily. In this specimen the plications are distinguishable readily on the ventral half of the conch but are very faint or practically obsolete on its dorsal half; contiguous whorls of the conch nowhere approach each other closer than 2 or 3 mm.

Remarks.—The annulations on the apical part of these conchs suggest that *Lituites cancellatus*, and the group of shells which it typifies, was derived from an ancestral form characterized by distinct oblique transverse annulations or plications, the annulations being strongly deflected downward along the ventral side of the conch. In this ancestral form the siphuncle probably had a central or sub-central position, and the cross-section of the conch may have been almost circular or slightly compressed laterally. The surface striations of this ancestral form probably were chiefly transverse, though longitudinal striations also may have been present.

Among known cephalopods, the species originally described as *Lituites bickmoreanum* by Whitfield, but here made the type of the new genus *Bickmorites*, most nearly approaches this ancestral type, though not regarded as the ancestral form itself.

Lituites occidentalis Hall.—The type of *Lituites occidentalis* was obtained by Hall from near Milwaukee, Wisconsin. It was never figured and the type itself was lost. Hall regarded his species as identical with *Lituites cancellatus* of McChesney, but claimed priority of publication for his name *occidentalis*. Unfortunately, his type has been lost, and there is no means of verifying the identity of these two forms, though this identity here is accepted. Hall's description in the 20th Rep. New York

State Cab. Nat. Hist., 1868, p. 363, is as follows, the terms dorsum and venter being interchanged in order to conform with present usage:

Shell very large, subdiscoidal. Volutions two or more, rapidly expanding, contiguous, the outer portion of the last volution becoming free and extending in a nearly straight line, while the earlier portions are compressed on the dorsal side by the venter of the preceding volution. Septa distant. Section elliptical. Siphuncle small, subcentral. Surface marked by regular equal fillet-like striae or ridges, which are curved backwards on the venter; and in more perfect individuals, these are cancellated by finer longitudinal or revolving striae. This species sometimes measures twelve inches in the greatest diameter of the disc. *Formation and locality.* In limestone of Niagara age, near Milwaukee, Wisconsin, and at Joliet, Illinois.

38. **Gigantoceras elrodi** (White)

Plate XIII, fig. 1; plate XIV, fig. 1; plate XVI, fig. 1

Gyroceras elrodi White, 11th Ann. Rep. Indiana Dep. Geol. Nat. Hist., 1882, p. 356, pl. 37, fig. 1; pl. 38, figs. 2, 3, 4.

Type specimen.—The type was found by Dr. Moses N. Elrod at Hartsville, Indiana, in the upper part of the Laurel limestone, immediately beneath the Waldron shale, in the Niagaran. Its present location is unknown. This type was adequately illustrated by the figures accompanying the original description. Noteworthy parts of this description are as follows:

Transverse section of the whorls having a nearly regular outline, except that the peripheral side is a little flattened, or its convexity is somewhat less than that of the umbilical side. Sutures extending nearly straight across the peripheral portion, and across the sides with gentle sinuosity. Siphuncle rather small, placed subcentrally, or a little nearer to the umbilical than to the peripheral side. The surface is marked by numerous revolving lines which are apparently distributed over the whole surface; and these are crossed by similar transverse lines, which evidently correspond with the lines of increase which were formed upon the borders of the aperture of the growing shell.

The latter lines extend across the whorls from the umbilical to the peripheral side, in an outward and backward direction, and with a curve, the convexity of which is forward.

St. Paul specimen.—A second specimen, from the same horizon, labelled as coming from St. Paul, Indiana (plate XIII, fig. 1; plate XIV, fig. 1; plate XVI, fig. 1), is numbered 15006 in Walker Museum at the University of Chicago. Since the maximum diameter of this specimen, which includes only the phragmacone, is 220 mm., it is evident that the complete specimen was much larger than the type. Moreover, the rate of enlargement of the conch in a dorso-ventral direction was greater, being comparable with that of *Lituites cancellatus*. The cross-section of this specimen, at the top of the phragmacone, differs from that of the type in being wider dorsad of the siphuncle, rather than ventrad from the latter, the ventral side being distinctly more narrowly rounded.

The last camera is distinctly shorter than the preceding one, indicating that the conch had reached full maturity. The number of camerae in a length equal to the dorso-ventral diameter, at the top of the series of camerae counted, is 3. The specimen has been sectioned parallel to the plane of the conch, exposing the septa. The only trace of the siphuncle is at the uppermost septum, and this trace consists of the septal funnel alone, no trace of the rings or cylinders connecting successive septal funnels being present. The center of this septal funnel is 48 mm. from the nearest part of the dorsal wall of the conch and 53 mm. from the ventral wall. Where the depression of the septum at the top of the septal funnel begins, its dorso-ventral diameter is 9 mm., diminishing to 6 mm. at the lower margin of this funnel. The length of this funnel scarcely equals 2 mm. On the dorsal side, the wall of this funnel curves more abruptly downward than on the ventral side.

The surface of the shell is crossed by transverse striae which curve strongly downward ventrally. Where the dorso-ventral diameter of the conch is 80 mm., 13 transverse striae occur in a length of 20 mm., on the ventro-lateral slope of the shell. Where the dorso-ventral diameter is 35 mm., 24 transverse striae occur in this length, along the ventral side of the conch.

Where this diameter is 30 mm., 30 transverse striae occur in this length, along the ventral side, and these transverse striae are crossed by 7 longitudinal striae in a width of 2 mm., or at the rate of 31 striae in a width of 10 mm.

Locality and horizon.—From the top of the Laurel limestone at St. Paul, Indiana, Specimen No. 15006, in Walker Museum, at the University of Chicago.

Remarks.—The flattening of the ventral side of the conch, mentioned in the original description of *Gyroceras elrodi*, contrasting with the more narrowly rounded dorsal side, suggests affinity of the type with the species described originally as *Nautilus oceanus* by Hall, and figured in this Journal. However, in that species the sutures of the septa curve strongly downward along the median part of the ventral side, while in *Gyroceras elrodi* they are described as "nearly straight across."

In the St. Paul specimen, the general appearance of the conch is very similar to that of *Lituites cancellatus*. Possibly the surface ornamentation is finer. In the type of *Lituites cancellatus* 8 or 9 transverse striae were stated to occur in a length of 25 mm. on the middle of the outer volution, the fine revolving striae numbering 4 or 5 in a width of 2 mm. In the St. Paul specimen of *Gyroceras elrodi*, however, 13 transverse striae occur in a length of 20 mm. where the dorso-ventral diameter of the conch is 80 mm., which is equivalent to 16 striae in a length of 25 mm.; and, at the only point at which the revolving striae were counted, there were 7 in a width of 2 mm. While, therefore, there is a possibility of a difference in the number and relative prominence of the striae in *Lituites cancellatus* and *Gyroceras elrodi*, this can not be regarded as fully established, since it is not known to what extent the number of these striae varies in different specimens of *Lituites cancellatus*.

39. **Gigantoceras abruptum** (Hall)

Plate XV, figs. 1A, 1B, 1C; plate XVI, fig. 3

Gyroceras abruptum Hall, 11th Ann. Rep. Indiana Dep. Geol. Nat. Hist., 1882, p. 325; Trans. Albany Institute, 10, abstract, p. 19, 1879; idem, p. 75, 1883.

Type specimen.—Specimen consisting of the lower part of the living chamber to which 5 camerae still are attached. The specimen may be immature, since the uppermost camera is not shorter than those immediately below. The specimen apparently includes about half of a volution. The missing, more apical portion of the phragmacone included at least half, possibly three-fourths of a volution, and more than half of the length of the living chamber is absent, so that the original maximum diameter of the conch probably exceeded 200 mm., equalling that of some specimens of *Gyroceras elrodi.*

The dorso-ventral apical angle of the conch is about 17.5 degrees, the corresponding lateral angle being about 14.5 degrees. The ratio of the lateral to the dorso-ventral diameter, both at the base of the specimen and at the top of the phragmacone is 87 per cent. There is no conspicuous difference between the transverse curvature of the dorsal and ventral sides of the conch, though the dorsal side appears slightly more broadly rounded. The flattening of the lateral sides is much less conspicuous than in *Gyroceras elrodi.* In fact, it is less conspicuous than in any form referred to *Gigantoceras.*

The number of camerae in a length equal to the dorso-ventral diameter of the conch is three and a half. The sutures of the septa have broad lateral lobes, which are shallow at the base of the specimen, but which increase to a depth of 8 or 9 mm. at the top of the phragmacone. At later stages of growth of the conch, the depth of these lobes must have been considerably greater, fully as great as in *Gyroceras elrodi.* At the lower end of the specimen the center of the siphuncle is 19 mm. from the dorsal margin of the septum and 21 mm. from its ventral margin, so that its position is nearly central. Nothing is known of the siphuncle beyond its location at this passage through the siphuncle. The septal funnel is assumed to be short, as in *Gyroceras elrodi.*

The surface of the shell is retained only along the median part of the dorsal side of the conch. At the base of the living chamber, where the dorso-ventral diameter is 63 mm., there are 12 or 13 revolving and relatively broad striations in a width

of 10 mm., crossed by much finer transverse striae, which number 20 in a length of 10 mm. On the dorsal side of the third camera beneath the living chamber, there are 8 revolving striations in a width of 4 mm., giving a rate of 18 or 19 in a width of 10 mm. The transverse striae are much finer, 12 occurring in a length of 4 mm., or at a rate of 28 or 29 in 10 mm. The vertical striae are much more conspicuous than the transverse ones.

Locality and horizon.—From the top of the Laurel limestone at Waldron, Indiana. The type, numbered 11995, is in the Walker Museum of Chicago University.

Remarks.—*Gyroceras abruptum* is distinguished readily from *Lituites cancellatus* and *Gyroceras elrodi* by the greater prominence of the vertical or revolving striae as compared with the transverse ones. The lateral compression of the conch is less than in any other known form of *Gigantoceras,* and the rate of expansion of the conch in a dorso-ventral direction is relatively small.

40. **Bickmorites** Gen. nov.

Genotype.—*Lituites bickmoreanus* Whitfield.

Gyroceracones with strongly marked transverse rib-like annulations, which curve strongly downward ventrally. The sutures of the septa have broad, but very shallow lateral lobes, and there may also be ventral lobes, with intermediate ventrolateral saddles; or the ventral lobes may be inconspicuous or absent. The siphuncle is located slightly ventrad of the center of the conch. In addition to the transverse rib-like annulations, there are transverse striae, parallel to the latter; apparently there were also vertical or revolving striae, at least in gerontic stages of the shell, but very little is known at present of these revolving striae. At gerontic stages of growth, the genotype looses its transverse annulations. The conch appears to have been compressed more or less laterally.

The conch resembles somewhat the trochoceroid forms typified by *Trochoceras desplainense* McChesney, but the latter is closely coiled and unquestionably trochoceran in its method of coiling. The species *Lituites marshii* Hall is placed provisionally in the

same genus, though its method of coiling is nautilian, rather than gyroceran.

41. **Bickmorites bickmoreanum** (Whitfield)

Plate XIX, figs. 1, 2, 3; plate XX, fig. 1

Lituites bickmoreanus Whitfield, Bull. Amer. Mus. Nat. Hist., 1, 1885, p. 191, pl. 21, figs. 1 to 3.

Gyroceracone, with the more closely coiled part of the conch attaining a maximum diameter of 135 to 170 mm. across the volutions; beyond this more closely coiled part the conch extends for a distance of 50 to 60 mm. in a lengthwise direction, its curvature diminishing rapidly. The latter part includes that portion of the conch crossed by the last 5 transverse oblique rib-like annulations. The terminal part of the conch, toward the aperture, is straight and ribless, and therefore is in marked contrast with the preceding rib-bearing part of the conch. In the type specimen (plate XIX, figs. 2A, B), figured by Whitfield, the length of this rib-less part is only 40 mm., but in a remarkably well preserved specimen (No. 22860; plate XIX, fig. 1), belonging to the University of Chicago, the rib-less part is 55 mm. in length. The more closely coiled part of the conch apparently does not include much more than about 2 volutions. Toward the apical part of the conch the volutions are about 5 to 7 mm. apart, but at the point where the larger end of the last volution begins to straighten the distance between the adjacent parts of the volutions is only about 2 or 3 mm. In the type specimen, and in the University of Chicago specimen cited above, the cross-sections of the volutions are essentially circular, the dorso-ventral diameter being only about one millimeter greater than the lateral one, there being a faint lateral flattening and a corresponding faint ventral flattening of the volutions. The total length of the phragmacone of the University of Chicago specimen, measured along the center of the volutions, is about 275 mm.; in this length the dorso-ventral diameter increases from 6 to 41 mm., or at the rate of 12.7 mm. in a length of 100 mm., forming an apical angle of 8 degrees. In laterally flattened specimens

this apical angle, of course, appears greater. The living chamber of the University of Chicago specimen is 175 mm. in length. Of this length, 120 mm. is ornamented by prominent transverse oblique rib-like folds, but toward the aperture, for a distance of 55 mm., rib-like folds are absent. Along the lower part of the living chamber, for a distance of about 65 mm., the rate of increase of the dorso-ventral diameter is about the same as in the phragmacone, but beyond this point it diminishes rapidly, and along the rib-less part of the phragmacone there is no enlargement of the conch. The lateral margins of the aperture form an angle of about 75 degrees with the vertical axis of the conch, curving more strongly downward on the ventral side.

At the larger end of the phragmacone, 10 camerae occupy a length of 83 mm., measured along the central axis of the phragmacone. The uppermost one or two camerae tend to be shorter than those immediately beneath. The sutures of the septa have broad, but very shallow, lateral lobes and somewhat narrower ventral lobes, with intermediate saddles at the ventro-lateral angles. The septa have a concavity of 7 or 8 mm. at a point where the diameter of the volutions is 41 mm. Their curvature is slightly greater in a lateral than in a dorso-ventral direction, the radii of curvature being 25 and 30 mm. respectively at the point mentioned above. Where the sutures cross the rib-like folds they necessarily curve more or less upward. The passage of the siphuncle through the septum is slightly ventrad of the center. Where the diameter of the volutions is 41 mm., the diameter of this passage is 2 mm. The septal funnel is directed toward the apical part of the shell, but the length of this funnel is not known, and no part of the connecting ring or cylinder remains between the successive funnels.

Transverse oblique rib-like folds ornament the surface of the shell along the entire length of the phragmacone and along most of the living chamber. Along the upper part of the phragmacone of the University of Chicago specimen, 10 of these folds occupy a length equal to that between 11 sutures, measured along the ventro-lateral angles of the volution, the corresponding length of the shell, measured along its axial part, being 80 mm. Along

the free part of the living chamber, 4 folds occur in a length equal to the diameter of the volution, the distance between the folds being measured along the axial line of the volution. In the University of Chicago specimen the folds are slightly crowded. The rib-like folds are prominent not only on the lateral sides of the volutions but also on their dorsal side; however, toward the median part of the ventral side they become much less conspicuous. The appearance of flattening along the ventral side of the last volution of the conch probably is due almost altogether to this diminution in prominence of the rib-like folds toward the median parts of this side. The rib-like folds are curved strongly backward along their entire distance from the median part of the dorsal side to the median part of the ventral side. This backward curvature is distinct even when viewing the volutions from their dorsal side. It is greatest along the ventro-lateral angles. The total backward curvature of the folds includes the length of 4 camerae, half of this backward curvature occurring between the ventro-lateral angles and the median line of the ventral side of the volutions, where the lateral sides of the hyponomic sinus form an angle of 75 degrees, relatively narrowly rounded at the apex. Along the straight rib-less part of the conch, toward its aperture, there are numerous close-set transverse striae, having the same direction as the rib-like folds, numbering from 25 to 30 in a length of 10 mm., where best preserved. Similar transverse striae may have ornamented the remainder of the shell, in addition to the ribs. Where less well preserved they appear more distant, the fainter striae disappearing. In the University of Chicago specimen cited above, 20 to 23 longitudinal striae occur in a width of 10 mm. along the rib-less part of the conch; similar longitudinal striae occur no doubt on the remainder of the surface of the shell, but have not been detected there.

Locality and horizon.—From the Niagaran at Wabash, Indiana. The type specimen, numbered 2131, is in the American Museum of Natural History, in New York City. Two additional specimens, numbered 22860 and 23101 (plate XIX, fig. 3A, B; plate XX, fig. 1) at the University of Chicago are from

the same locality. The first of these preserves even the outline of the aperture; the second is distinctly compressed laterally.

Remarks.—Specimen No. 22860, at the University of Chicago, differs from most specimens of this species found at Wabash, Indiana, in having the rib-like folds more abruptly and more prominently elevated above the intermediate concave areas, this prominence being conspicuous even along the median parts of the dorsal side of the volutions. Moreover, the rib-like folds do not rise as strongly along this dorsal side, but tend to take a more directly transverse course along this part of the shell.

42. **Bickmorites marshi** (Hall)

Plate XXI, figs. 2A, B; 3; 4

Lituites marshi Hall, 20th Rep. New York State Cab. Nat. Hist., 1868, p. 362, pl. 16, figs. 6, 7.

Gyroceracone, with all the volutions of the phragmacone either in contact with each other or so slightly removed from one another that their gyroceran form of coiling has not been detected as yet. There is no evidence that the dorsum of any part of any specimen ever was impressed by the venter of a preceding volution, as in many nautilicones. In later stages of growth, the upper half of the living chamber becomes distinctly free from the more closely coiled part of the conch, and diverges at a tangent. The distance across the more closely coiled part of the gyroceracone usually equals about 80 or 85 mm., before conspicuous divergence of the upper part of the living chamber takes place.

The type specimen (plate XXI, figs. 2A, B) apparently includes all of the phragmacone, since the uppermost camera, at the larger end of the specimen, is distinctly shorter than the adjacent ones. No part of the living chamber remains, and therefore the tangential divergence of the upper part of the last volution is not shown. In fully mature conchs, the base of the living chamber attains a dorso-ventral diameter of 20 to 23 mm.; beyond this base, the living chamber continues for a length of 70 to 90 mm. before it diverges tangentially from the closely coiled part of the conch.

The free part of the living chamber tends to become straight. How great a length the straight part attains is not known, but in one specimen it is 40 mm. long without showing any trace of the aperture.

The number of volutions belonging to the phragmacone equals about two and a quarter or two and a half, as far as can be determined in the absence of a clearly defined apical end. Since that part of the living chamber which coils closely against the preceding volution is about a quarter of a volution in length, the closely coiled part of the conch includes a total of 2.5 to 2.75 volutions.

The rate of increase of the dorso-ventral diameter of the conch suggests an apical angle of about 3.75 degrees in the type specimen, from Kankakee, Illinois, and of 4 and 4.25 degrees respectively in two specimens from Joliet, Illinois. The cross-sections of the whorls are nearly circular. In the type specimen the dorso-ventral diameter is 21 mm., and the lateral diameter is estimated at 22 mm. Similar, essentially circular specimens occur at Joliet, Illinois, but most specimens from this locality appear laterally compressed, probably as the result of compression during fossilization. If the oblique transverse rib-like folds were removed, the volutions would appear moderately compressed laterally, with a tendency toward angulation along the ventro-lateral shoulders. In consequence of the prominence of the rib-like folds at the ventro-lateral angles and their rapid diminution in elevation toward the median part of the ventral side, this side appears more or less flattened, but even in this condition a slight convexity remains, and is shown not only by the type but even more distinctly by other specimens. Where later volutions are in contact with earlier ones, the area of contact does not exceed 7 mm., where the lateral diameter of the earlier volution is 17 mm.

Near the larger end of the phragmacone of the type specimen, about 3 camerae occupy an axial length equal to the dorso-ventral diameter, but along earlier parts of the phragmacone their combined length may exceed this dorso-ventral diameter more or less, in some cases as much as half a camera, so that two

and a half camerae may occur in this length. In some specimens the number of camerae in this distance equals 4. The sutures of the septa are rather deeply concave along the lateral sides of the volutions, producing distinct lobes whose maximum concavity is slightly ventrad of the axial line. Toward the dorsal side, the sutures show a slight tendency toward reversal of curvature, thus lowering the height of the dorsal saddles. There is a corresponding lowering of the height of the saddles on the ventral side of the volutions, where the crest of the saddles, between the ventro-lateral angles of the volutions, is almost directly transverse.

The surface of the conch is traversed by oblique transverse rib-like folds. In the type specimen, 13 folds occupy the same length as 14 sutures along the half volution forming the larger end of the phragmacone. The next 20 folds in an apicad direction occupy the same length as 19 sutures. The next 8 folds occupy the same length as 7 sutures. The tendency is toward small difference between the number of folds and that of the sutures at later stages of growth of the conch. The folds curve strongly backward along the lateral sides of the volutions, the total distance traversed parallel to the axial line equalling the length of two camerae. Along the dorsal side of the volutions the direction of the folds is nearly directly transverse. From the dorsal sutures between the volutions to within a short distance from the ventro-lateral angles the folds form an angle of about 70 degrees with the longitudinal axis of the conch, and then curve backward so strongly that this angle becomes more nearly 45 or 40 degrees. On the ventral side of the volutions, these folds indicate the former depth of the hyponomic sinuses, with their sides diverging at an angle of 90 degrees. At the dorsal sutures between the volutions the folds are only moderately prominent. Their prominence and width increases rapidly toward the ventro-lateral angles and become greatest just before reaching the latter. Thence, their prominence and width diminishes rapidly toward the median parts of the ventral side of the volutions, where they may become either faint or obsolete.

Locality and horizon.—From the Racine dolomite. The type,

specimen No. 2130, is from Kankakee, Illinois, and is in the American Museum of Natural History in New York City. Two specimens from Joliet, Illinois (plate XXI, fig. 3), are in the University of Chicago. They are numbered 22964; a third specimen, from the same locality, is numbered 847, and is so badly weathered that it retains the oblique transverse rib-like folds only near the dorsal and ventral sides, but the specimen is of special interest because it retains the lower part of the tangentially diverging portion of the living chamber. Another specimen in the University of Chicago, numbered 22934 (plate XXI, fig. 4), and labelled as coming from Wabash, Indiana, is doubtfully referred to this species.

Remarks.—The figures of the type specimen presented by Hall are somewhat misleading in several respects. In his figure 6, giving a lateral view of the phragmacone, the crests of the rib-like folds are too acute, and at their dorsal ends these folds curve distinctly upward instead of crossing the dorsal side of the whorl nearly in a directly transverse manner. In his figure 7, showing the area of contact between successive volutions along the ventral side of the last volution of the phragmacone, the lateral limits of this area are sharply defined, instead of being vaguely indicated as in the original specimen.

Generic relations.—Provisionally *Lituites marshi* is referred to *Bickmorites* although it appears to have a nautilian conch while that of the genotype of *Bickmorites*, namely *Lituites bickmoreanus* is gyroceran. It is possible that further knowledge of *Lituites marshi* may reveal other differences more or less of generic value, but in the present state of our knowledge of the two species involved it does not seem advisable to institute a distinct genus for the nautilian form.

43. **Jolietoceras** Gen. nov.

Genotype.—*Jolietoceras senescens* Sp. nov.

Conch apparently loosely gyroceraconic in its earlier stages of growth, becoming straight in its gerontic stages. At the point where the conch becomes straight, its dorsal side is more or less angulate, owing to a distinct decrease in the rate of en-

largement of the conch. The curved part of the conch is crossed by oblique transverse folds or annulations which are most distinct along the ventral half of the conch, becoming indistinct dorsally. Along the straight part of the conch these oblique folds become obsolete. The siphuncle is central in location.

Jolietoceras is regarded as related to *Gigantoceras* and *Bickmorites*.

44. **Jolietoceras senescens** Sp. nov.

Plate XXII, figs. 1, 2; plate XXIII, fig. 1

Type.—Specimen (plate XXII, fig. 2; plate XXIII, fig. 1) strongly curved at the base, becoming straight along its upper part. The straight part forms the larger and more conspicuous part of the phragmacone. The radius of curvature of the ventral side of the specimen changes from 47 mm. along the lower part of the specimen to 85 mm. farther up, the straight part of this ventral side being 100 mm. in length. The radius of curvature of the dorsal side changes from 23 mm. at the base to 35 mm. farther up; there is an angulation 75 mm. below the uppermost clearly defined suture; above which point the dorsal outline becomes straight. This angulation appears to be a characteristic feature of the species.

From the base of the specimen to the base of the eighth camera, counting downward from the top, the apical angle in a dorso-ventral direction is 14 degrees. Above this, the conch enlarges on the dorsal side in a more or less gibbous manner for a distance of 2 camerae, above which the apical angle is reduced to 10 degrees for the remainder of the length of the specimen, all of which belongs to the phragmacone. Judging from the apical angle, and the rate of enlargement of the conch at its smaller end, the coiled part of the conch is only about one and a third volutions in length.

The conch is strongly compressed laterally, at least in its present state. The degree of compression increases toward the top. At the base of the fourteenth camera below the top of the specimen, the ratio of the lateral diameter to the dorso-ventral

one is estimated at 71 per cent; at the base of the third camera it is estimated at 52 per cent.

Along the more strongly coiled part of the conch, 4 camerae occupy a length equal to the dorso-ventral diameter at the top of the series being counted, but along the straight part of the phragmacone the number of camerae along a corresponding length is 5. The sutures of the septa practically are directly transverse; along the more strongly curved part of the conch they tend to be slightly concave along the lateral sides. The siphuncle is not exposed in this specimen.

Along its strongly curved part, the conch is crossed transversely by low but broad folds which are faint toward the dorsal side, but become more and more distinct toward the ventral side, toward which they slope obliquely downward. The folds cross the sutures at angles of about 30 degrees. The presence of these folds suggests that the hyponomic sinus, during earlier stages of growth of the conch, was correspondingly deep.

Locality and horizon.—From the Niagaran at Joliet, Illinois where it was found in the Patterson quarry beds at Lake Joliet. Specimen No. 22030 in Walker Museum, at the University of Chicago.

Harvard specimen.—A second specimen (plate XXII, fig. 1) of the same species is preserved at Harvard University, where it is numbered 2313. It was found in the Waukesha dolomite of the Niagaran in Schoonmaker's quarry, at Wauwatosa, Wisconsin. It is noteworthy chiefly in exposing the passage of the siphuncle through the septum exposed by the break near the base of the specimen. Here the location of the siphuncle is central.

45. **Tyrrelloceras** Gen. nov.

Genotype.—*Trochoceras insigne* Whiteaves.

Conch gyroceran, loosely coiled, with a very large umbilical opening. Slightly compressed laterally. Transverse ribs curving downward toward the ventral side, becoming obsolete on the periphery or venter. The most characteristic feature consists in the presence of small, acute, thread-like ridges which extend

along the conch in a longitudinal or spiral manner. The sutures of the septa are rather deeply concave. The location of the siphuncle is unknown; possibly, in analogy with *Bickmorites*, it was nearly central.

46. **Bickmoritidae** Nom. nov.

In the Zittel-Eastman Text-book of Paleontology the family *Uranoceratidae* was proposed, to include the two genera *Uranoceras* Hyatt and *Gigantoceras* Hyatt. In the opinion of the present writer, these two genera belong to two distinct families, of which the one typified by *Uranoceras* is not annulated while the one typified by *Gigantoceras* in one genus is annulated at all stages of growth, and in several others retains evidence of annulation only in its earlier stages of growth. In *Uranoceras*, the cross-section tends to be more quadrangular, and the siphuncle is more distinctly ventrad of the center of the conch, but these differences are not family characteristics. In *Uranoceras*, the structure of the siphuncle is distinctive in the broadly cylindrical form of the segments of the siphuncle within the camerae, rounded at both ends, the septal funnels contracting to about one third of the width of the intervening connecting rings. No trace of such a structure is found in any species here referred to *Gigantoceras*; in fact, such a structure of the siphuncle is regarded as absent in that genus.

The chief characteristics of *Gigantoceras* are the presence of strongly oblique annulations or rib-like folds in early stages of growth, the loosely gyroceran mode of growth of the conch, the central location of the siphuncle, the short septal funnels, not spreading out at their base, and the readiness with which the connecting rings disappear, no trace remaining in any of a considerable number of individual specimens examined. These characteristics are shared by *Gigantoceras* with the genera here described as *Bickmorites* and *Jolietoceras*. Of these three genera *Bickmorites* appears a little more primitive than the other two, and hence is selected as the type of the family, the name *Bickmoritidae* being proposed for the latter. Possibly *Tyrreloceras* belongs here also.

47. **Discoceras** Barrande

Genotype.—*Clymenia antiquissima* Eichwald, Die Urwelt Russlands, 2, 1842, p. 33, pl. 3, figs. 16, 17; Lethaea Rossica, 1, 1860, p. 1301.

Discoceras antiquissimum Barrande, Systeme Silurien du Centre de la Boheme, 2, Distribution horizontale et verticale des Cephalopodes, 1870, p. 37; also vol. 2, pt. 4, 1877, p. 62.

The type of *Clymenia antiquissima* (plate XVIII, figs. 1A, 1B) is figured by Eichwald as consisting of about 5 volutions, enlarging rather slowly. The earlier volutions are described as considerably higher dorso-ventrally than broad laterally, but the width increases more rapidly than the height with age, so that the last volution is depressed, the lateral diameter being 33 mm., while the dorso-ventral one is only 27 mm. The immediately preceding volution is about 23 mm. wide and high, the cross-section being oval, broader ventrally and narrower dorsally. The dorsal side of the volutions is slightly impressed. Four camerae occupy a length equal to the dorso-ventral diameter. The sutures of the septa curve distinctly downward along the lateral sides of the volutions; they curve distinctly upward along the ventro-lateral angles, and they curve slightly downward along the ventral side. The siphuncle is dorsal in location. In the earlier volutions it is not in actual contact with the dorsal wall, but toward the top of the phragmacone it is in contact. The shell is strongly ribbed by oblique transverse annulations which curve strongly downward from the dorsal toward the ventral side for a distance equal to the height of 2 camerae. They are much less numerous than the camerae, 7.5 camerae occurring in a length including the crests of 4 annulations. In addition to the annulations there are numerous fine transverse striae, parallel to the oblique annulations.

The type was described from the island of Dagö, where it occurs near Kertel; the horizon is given by Eichwald as that of the *Orthoceras* limestone, but Prof. Raymond (Bull. Mus. Comparative Zoology, Harvard College, 56, No. 3, (1916) p. 203) notes only the presence of erratic limestone blocks of Kegel age on

the shore at Kertel, the Kegel being regarded by him as of Trenton age.

48. **Graftonoceras** Gen. nov.

Genotype.—*Lituites Graftonensis* Meek and Worthen.

Hyatt referred *Lituites Graftonensis* Meek and Worthen and *Lituites multicostatus* Whitfield to *Discoceras*. They differ from *Discoceras*, however, in the following particulars. The cross-section of the whorls in broader dorsally, and is more impressed there by the ventral side of the preceding volution. The oblique transverse annulations, moreover, are relatively much more numerous and crowded together. The course of the sutures in both genera is closely similar. The genera evidently are closely related. *Graftonoceras* may be regarded as a derivative of *Discoceras*.

Among American species referred to *Discoceras*, the form described by Whiteaves as *Discoceras Canadense*, from the Black River or Richmond at Little Black island on Lake Winnepeg, closely resembles typical *Discoceras* on lateral view, but the conch is strongly compressed laterally, and the siphuncle is not in contact with the dorsal side, though closely approaching the latter. The fact that the ventral side is more broadly rounded than the dorsal side is of interest.

The species originally referred by Prof. W. A. Parks to *Trochoceras insigne* Whiteaves, but later described and figured by him as *Discoceras* (?) *shamattawaense*, was found on the lower rapids of the Shammatawa river, Manitoba, west of Hudson Bay, in the Shammatawa limestone, of Richmond age, in the Ordovician. Of this conch, only the exterior is known, and this is ornamented by rather numerous transverse ribs which curve much less strongly backward than in typical *Discoceras*. Moreover, the conch appears to be more strongly compressed laterally than in that genus.

49. **Graftonoceras graftonense** (Meek and Worthen)

Plate XII, figs. 2, 3

Lituites Graftonensis Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1870, p. 51; Geol. Surv. Illinois, 6, 1875, p. 507, pl. 25, fig. 1.

Type.—Nautilicone (plate XII, fig. 2 A-C) enlarging from a dorso-ventral diameter of 8 to 14 mm. in a length of one volution. The ratio of the dorso-ventral diameter to the lateral one is estimated as that of 13 to 16 mm. at a point about a third of a volution from the aperture. The cross-section of the volutions is reniform. Each volution slightly overlaps the ventro-lateral side of the preceding volution, the transverse curvature of the overlapping volution tending to be slightly concave for a depth of half a millimeter. No trace of this concave curvature is seen on casts of the interior of the conch; it is confined to the surface of the shell, the latter being relatively thick. The transverse ribs are relatively narrow, scarcely equalling one millimeter in width even near the aperture of the conch. About 5 transverse ribs occur in a length of 20 mm. toward the aperture, increasing to 7 ribs in the same length about half a volution back from the aperture. A cast of the interior of the conch indicates that the ribs are confined to the surface of the shell, leaving no trace on its interior. The ribs curve backward along their entire length, but the curvature is increased greatly along the ventro-lateral parts of the conch, the hyponomic sinus being deeply V-shaped. When viewed from the ventral side, the backward curvature of the ribs equals 11 mm. where the lateral diameter of the volution is 17 mm. The curvature of the ribs along the median line of the ventral side is narrowly concave. In addition to the transverse ribs there are numerous transverse striae having the same direction as the ribs. These striae vary from 5 to 6 in a length of 2 mm. in different parts of the specimen not far removed from each other.

Locality and horizon.—From the Racine dolomite at Grafton, Illinois. The type specimen, numbered 2681, is in the Illinois State Museum of Natural History in Springfield, Illinois. Both the figured specimen, and the cast of the interior of the same specimen are present.

A specimen of *Graftonoceras graftonense*, numbered 7304 (plate XII, fig. 3), at Ohio State University, was found in the Niagaran at Rising Sun, Ohio. The Niagaran at this locality corresponds to the Cedarville dolomite in age.

50. **Graftonoceras ortoni** (Meek)

Plate XII, figs. 4, 5

Lituites (?) *ortoni* Meek, Geol. Surv. Ohio, 2, 1873, p. 186, pl. 15, fig. 4; called *Gyroceras ortoni* at end of this description.

Cf. Lituites multicostatus Whitfield, Geol. Wisconsin, 4, 1882, p. 303, pl. 20, fig. 7.

Small nautilicone with a maximum diameter of about 50 mm. Volutions with a reniform cross-section, the inner or dorsal side having a shallow, but broad impressed zone; the ventral side being more narrowly rounded than the dorsal. Volutions enlarging slowly; from 9 to 13 mm. in a dorso-ventral direction in Wilmington specimen here figured. Camerae numbering from 2 to 2.5 in a length equal to the dorso-ventral diameter of the volution. The sutures have a slightly concave curvature or lobe on the lateral sides of the conch, rising toward the ventral side; across the median part of the ventral side the sutures either are directly transverse or curve almost imperceptibly downward. The concavity of the septa equals 2.7 mm. where the dorso-ventral diameter is 11 mm. The siphuncle is in contact with the inner or dorsal side of the volution; it appears depressed in cross-section, and is slightly over 2 mm. in width where the dorso-ventral diameter is 11 mm.

The surface of the shell is marked by low transverse ribs which curve strongly bckward, almost as far as the median part of the ventral side of the volutions, changing in direction there with a relatively rapid curve. About 7 of these ribs occur in a distance of 10 mm., measured in a direction at right angles to their trend.

The type specimen consists only of a cast of the interior of the phragmacone, showing no trace of the transverse ribs seen on the exterior surface of this species, but the form and rate of enlargement of the volutions, the size of the camerae, and the curvature of the sutures are identical with those of the Wilmington specimen, in which the transverse ribs are preserved.

Locality and horizon.—From the Cedarville dolomite. The type, numbered 3404 (plate XII, fig. 5), was found at Greenville, Ohio. The Wilmington specimen, numbered 7057 (plate XII,

fig. 4), retains the ribs. Both specimens are preserved in the Museum of Ohio State University.

51. **Oonoceras** Hyatt

Genotype.—*Cyrtoceras acinacies* Barrande, Systeme Silurien du Centre de la Boheme, pl. 118.

No genotype was specified by Hyatt in his description of *Oonoceras,* but the first species named by him in this connection is regarded as the genotype; this is the form described by Barrande under *Cyrtoceras acinacies.* In this species the rate of enlargement of the dorso-ventral diameter of the conch is very small, and the amount of lengthwise curvature, especially along the lower end of the specimen, is such as to suggest that the entire specimen had a gyroceran form of coiling, possibly including nearly 2 volutions. The conch is compressed laterally, the transverse curvature of the ventral side being slightly more rapidly convex than that of the dorsal side. The living chamber is relatively short, apparently only slightly longer than broad in a dorso-ventral direction. The conch is distinctly compressed in a lateral direction. The aperture is oval in form, narrower ventrally, but not conspicuously contracted, though the upper part of the interior of the living chamber is somewhat narrower laterally than the lower part of this chamber, chiefly owing to a thickening of the shell of this chamber along its interior. The sutures of the septa have broad lateral lobes, and corresponding dorsal and ventral saddles. The siphuncle is located close to the ventral wall of the conch. In transverse longitudinal sections, the segments of the siphuncle enlarge only slightly within the camerae. According to Hyatt, the "septa rise rapidly on the ventral side, and may bend sharply orad, forming a funnel ridge or shoulder on that side, but disappearing on the opposite side of the same funnel. When the funnel itself is absent, the ridges look like reversed funnels or collars."

52. **Oxygonioceras** Gen. nov.

Genotype.—*Trochoceras oxynotum* Barrande, Systeme Silurien du Centre de la Boheme, 2, pl. 14, figs. 1 to 11.

The genotype of *Oonoceras* Hyatt is *Cyrtoceras acinacies* Barrande. From this species *Trochoceras oxynotum* Barrande differs in the following particulars. The coiling of the conch is trochoceran. The surface of the shell is not crossed by oblique annulations. Its ventral margin is acutely angulated. The segments of the siphuncle are beaded; they are relatively short and wide, and are strongly contracted at their passage through the septa. In figures 6 and 7 published by Barrande the height of the segments of the siphuncle compared with their width is in the ratio of 6 to 9, while the ratio of the passage of the siphuncle through the septum to the lateral diameter of the segment of the siphuncle is as 2.5 to 9.

These differences are sufficient, in the estimation of the writer, to indicate a distinct generic relationship, and the name *Oxygonioceras* is proposed, with *Trochoceras oxynotum* Barrande as the genotype.

53. **Oxygonioceras** cf. **cuneatum** (Whitfield)

Plate XXI, fig. 1A, B, C

Cyrtoceras (?) *cuneatum* Whiteaves, Geol. Surv. Canada, Pal. Foss., 3, 1906, p. 282; Ottawa Nat., 20, p. 133, two figures.

Original description.—

> Shell widely arcuate, strongly but rather obliquely compressed, very narrow on the periphery or venter, much wider but narrowly rounded on the dorsum, the outline of the transverse section being ovate cuneate, and the lateral diameter to the dorso-ventral about as three to five.
>
> Septa averaging about six millimeters apart laterally, the sutural lines being shallowly concave on both sides and produced into a narrow pointed saddle on the venter. Siphuncle and test unknown.
>
> The specimen upon which the foregoing description is based is a cast of the interior of part of the septate portion of the shell. It is evidently not a true *Cyrtoceras*, but a probably new generic type, of which there is not yet sufficient material to define satisfactorily.

From the Niagaran at Stonewall, Manitoba.

In the Ottawa Naturalist, cited above, the following state-

ments regarding the siphuncle are added: "Shape and position of the siphuncle not very clearly defined in the only specimen collected, though at the smaller end thereof there are indications that it was eccentric and placed a little on the ventral side of the center."

Wabash specimen.—In the Niagaran at Wabash, Indiana, a specimen was found which agrees with the Stonewall specimen in its lengthwise curvature, in the course and relative number of the sutures of the septa, and in the acute cross-section of the ventral side of the conch; however, the dorsal side of the cross-section of the Wabash specimen is not rounded, but tends to be angular in a manner similar to the ventral side; hence, it is not certain that the Wabash specimen is identical specifically with the Stonewall type. The location of the siphuncle in the Wabash specimen is unknown, and this may prove another difference. The description of the Wabash specimen is as follows:

Conch remarkable for its strong lengthwise curvature, its slow rate of increase in size, and its strong lateral compression. The radius of lengthwise curvature is 72 mm. along the ventral side and 40 mm. along the dorsal side. The dorso-ventral diameter of the conch at the lower end of the specimen is 29 mm.; above this point, at successive intervals of 5 cm., the dorso-ventral diameter is 33, 34, 35.5, and 37 mm. Judging from this slow rate of increase in size of the specimen, the entire conch must have included about two and a half volutions. The specimen at hand includes almost half of the last volution of the phragmacone, and the basal part of the living chamber. Judging from this specimen, the diameter of the entire conch, measured across the umbilicus, was 150 mm. Successive volutions must have been in contact with each other unless the conch was trochoceran. There is no definite evidence of either form of structure; there is no direct evidence of contact between successive volutions, either with or without an impressed zone, and there is no definite evidence that the conch was trochoceran. At the base of the living chamber, the dorso-ventral diameter is 37 mm., and the lateral one is 24 mm. Both the ventral and the dorsal sides of the conch are conspicuously angular in a transverse direction,

the angle varying from 75 to 90 degrees along different parts of the specimen. How much of this angulation is due to compression during fossilization is unknown.

The number of camerae in a length equal to the dorso-ventral diameter of the conch is 8. The sutures of the septa form conspicuous lateral lobes attaining a maximum depth of 6 or 7 mm. The corresponding ventral and dorsal saddles are acutely angular, the angles varying from 75 to 90 degrees. The curvature of the septa appears to be distinctly less in a lateral direction than dorso-ventrally, but this may be due to the relatively short length of the lateral diameter. The location of the siphuncle is unknown.

Locality and horizon.—From the Niagaran limestone at Wabash, Indiana. Specimen No. 22927, Walker Museum, University of Chicago.

Remarks.—In the description of the type of *Cyrtoceras cuneatum*, from Stonewall, Manitoba, the cross-section of the conch is described as ovate cuneate, the ventral side being acutely angular, and the dorsal side narrowly rounded; moreover, the conch is described as rather obliquely compressed.

Possibly *Cyrtoceras cuneatum* is related to the species described by Barrande as *Trochoceras oxynotum*. This will not be known definitely until the location of the siphuncle and the exact structure of its segments are discovered in the case of the Manitoba species. Judging merely from the external features presented, *Cyrtoceras cuneatum* belongs to the genus *Oxygonioceras* here proposed.

The only American cephalopod known at present, which has a cross-section similar to that of *Cyrtoceras cuneatum*, is an unpublished form, from the Vaurial formation of Anticosti, for which I have proposed the name *Goniotrochoceras twenhofeli*. The latter differs from typical *Cyrtoceras cuneatum* in having distinct transverse ribs, at least along the upper side of the whorl; possibly also along its lower surface, but the latter is not preserved. In addition, there are longitudinal striae. The location and structure of the siphuncle of *Goniotrochoceras twenhofeli* are unknown, and, until this is discovered, the family relationship of this genus must remain in doubt.

In *Mitroceras*, the conch is trochoceran in its form of coiling, and the cross-sections of the whorls are obliquely ovate, somewhat as in *Trochoceras oxynotum*, but with a much taller spire, and the upper slope of the whorls is more oblique and faces more strongly outward, as well as upward. But in *Mitroceras* the siphuncle is located along the middle of this upper oblique face, and does not occur in the outer marginal acute angle, as in *Oxygonioceras*.

54. **Ophidioceras wilmingtonense** Sp. nov.

Plate XXIV, figs. 3, 4

Type.—Small discoidal nautilicone (plate XXIV, figs. 4A, 4B), 26 mm. in diameter, possibly attaining a diameter of 30 mm.; the specimen here described includes three and a quarter volutions. Volutions slightly compressed laterally, attaining a lateral diameter of 6 mm. where the dorso-ventral diameter is almost 7 mm. When viewed from the ventral side, the median third of the width of the volution is occupied by a relatively broad and shallow concave band, which is sharply limited by a raised edge from the lateral sides of the conch. The lateral sides are less strongly convex than the relative size of the lateral and dorso-ventral diameters might suggest. They are crossed by transverse ribs which are nearly straight from the dorsal sutures to within 2 mm. of the margin of the concave ventral band; from this point they curve more strongly backward and become rapidly less prominent, practically disappearing about one millimeter from the band. Here, one millimeter from the band, the transverse curvature of the lateral sides reverses, becoming slightly concave as far as the band. The specimen here described consists of a cast of the exterior of one side of the conch. It has been illuminated from the lower left-hand corner, so as to present the appearance of the conch itself, in the figure presented on plate XXIV. This specimen in from Yellow Springs, Ohio, and is numbered 3405 in the Museum at Ohio State University.

A second specimen, from the Moodie quarry at Wilmington, Ohio, is in the Austin collection, at the U. S. National Museum. It is a cast of the interior of the phragmacone. Owing to the

thinness of the shell, it reproduces some of the surface features of the latter, in addition to showing the sutures of the septa. In this specimen, the sutures occupy the spaces between the transverse ribs, indicating that they approximately equalled the latter in number. Toward the ventral side of the volutions the ribs become indistinct. The concave band along the median part of the ventral side is not preserved.

A third specimen (plate XXIV, fig. 3), No. 2273 in the Museum of Comparative Zoology at Harvard University, is from the Racine dolomite somewhere in Wisconsin.

Additional specimens occur from the Racine of Wisconsin in the Teller collection in the U. S. National Museum.

55. **Antiphragmoceras** Gen. nov.

Genotype.—*Antiphragmoceras ulrichi* Sp. nov.

Exogastric cyrtoceraconic conchs, strongly compressed laterally, and somewhat flattened dorsally, so as to present a cuneiform cross-section with the narrower angle at the venter. The lengthwise curvature of the dorsal side is gently concave, that of the ventral side is strongly convex along the phragmacone, becoming slight along the living chamber. Siphuncle exogastric, nummuloidal. Aperture narrow along its ventral half, terminating at a projecting lip-like hyponomic sinus. The dorsal half of the aperture tends to be quadrangular at the dorsolateral angles, narrowing ventrally into the more linear part of the aperture. Along the dorsal margin of the aperture there are three narrow sinuses, one median, and the other two dorsolateral.

Compared with *Phragmoceras*, the lengthwise curvature of the conch is exactly reversed, that of *Phragmoceras* being such as to produce an endogastric conch.

The genus *Inversoceras*, proposed by Herman Hedström, with *Phragmoceras perversum* Barrande as the genotype (Sveriges Geologiska Undersökning, ser. Ca, No. 15; Ueber die Gattung Phragmoceras in der Obersilurformation Gotlands, 1917, p. 7) resembles *Antiphragmoceras* only in the inversion of the location of the siphuncle. In *Phragmoceras perversum* the rate of en-

largement of the dorso-ventral diameter of the conch is much less and its cross-section is elliptical, with a moderate amount of lateral compression, rather than cuneate. The dorsal lobe of the aperture is restricted to the extreme dorsal part of the conch, where it projects beyond the vertical dorsal outline of the lower and middle part of the living chamber. About 3 mm. beneath the dorsal margin of this lobe, the dorsal wall of this living chamber is distinctly infolded in a transverse direction. The dorsal lobe of the aperture faces upward and backward. Its outline is transversely elliptical, but at each end of its lateral diameter there is a small rounded sinus. Between each of the small lateral sinuses and the narrowly contracted linear part of the aperture the intermediate part of the shell extends backward dorsally in a more or less dentate manner.

56. **Antiphragmoceras ulrichi** Sp. nov.

Plate III, fig. 3; plate XVII, fig. 5; plate XXIII, fig. 2; plate XXIV, figs. 1A, 1B

Type.—Cyrtoceraconic, with the siphuncle located along the convexly curved side of the conch. The concavity of the dorsal side is relatively slight and extends as far up as mid-height of the living chamber. The convexity of the ventral side has a radius of 75 mm. along the phragmacone, until within a short distance of the base of the living chamber, beyond which the curvature becomes slight. Above mid-height of the living chamber, the conch contracts both dorsally and ventrally, especially the latter, the lip at the hyponomic sinus projecting prominently. The cross-section of the conch is cuneate in outline, the acute angle being ventral. The lateral sides of the conch are distinctly flattened, and converge toward the ventral side. The dorsal side also is distinctly flattened, though to a lesser degree. In a lateral direction the conch enlarges until within a short distance of the living chamber, and above this level presents nearly parallel lateral outlines until within a short distance of the dorso-lateral sinuses of the aperture. The living chamber is remarkably large, considering the size of the phragmacone. The dorsal

lobe of the aperture is somewhat pentagonal in outline, its posterior outline being quadrangular, the unpaired angle being located along the median line of the aperture, at mid-length, when viewed from above. The middle of the posterior margin and the postero-lateral angles of this dorsal lobe are marked by distinct sinuses, which project exteriorly as short vertical buttresses. The lateral margins of this dorsal lobe are subparallel in direction or converge slightly ventrally. The two sides converging abruptly in a ventral direction connect with the narrowly linear part of the aperture, at the ventral end of which the hyponomic sinus projects in the form of a distinct lip. The camerae are of small height and are correspondingly numerous. The sutures of the septa are straight, but are more closely crowded dorsally than ventrally. Faint vertical ribs cross the casts of the interior of the camerae, as in numerous other cyrtoceroid cephalopods. The siphuncle is located close to the ventral side of the conch. Its nummuloidal segments attain a diameter of 12 mm. where the dorso-ventral diameter of the conch is 73 mm., at the top of the phragmacone.

Locality and formation.—From Beech creek, near Mooney, Tennessee, in the area of the Waynesboro quadrangle. In the Hermitage division of the Trenton. In the U. S. National Museum.

This most interesting species, strongly Phragmoceroid in appearance, is named in honor of Dr. E. O. Ulrich, to whom the writer is greatly indebted in many ways.

PLATE I

Fig. 1. *Uranoceras hercules* (Winchell and Marcy). Lateral view; apical part of conch not preserved. From Chicago, Illinois; in the Racine dolomite. No. 27938, at U. S. National Museum.

Fig. 2. *Uranoceras uranum* (Barrande). A, lateral view; B, vertical section of another specimen, showing structure of siphuncle. Both figures reduced to five-ninths of natural size. Copied from Systeme Silurien du Centre de la Boheme, 2, pl. 196, figs. 12, 15. See also *plate IV, figs. 2A, 2B;* and *plate VII, fig. 3,* of this Journal.

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PLATE II

Fig. 1. *Uranoceras hercules* (Winchell and Marcy). Lateral view; apical part of conch not preserved. From Chicago, Illinois; in the Racine dolomite. No. 25851, U. S. National Museum. In removing the matrix from the dorsal side of the living chamber, a part of the conch may have been cut away, shortening the dorso-ventral diameter toward the aperture possibly as much as 10 mm.

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PLATE III

Fig. 1. *Uranoceras hercules* (Winchell and Marcy). Lateral view, with an attempt at the restoration of the missing apical part. Reduced to four-fifths of natural size. Racine, Wisconsin, in Racine dolomite. No. 22948, at the University of Chicago. See also *pl. VIII, figs. 1A, 1B* of this Journal.

Fig. 2. *"Nautilus" oceanus* Hall. Ventral view, with left margin of conch missing, showing ventral lobes and dorso-lateral saddles. Magnified to five-fourths of natural size. From Flat Rock Creek, in Shelby county, Indiana, from top of Laurel limestone. No. 12329, New York State Museum. See also *pl. IX, fig. 1;* and *pl. XVII, fig. 1* of this Journal.

Fig. 3. *Antiphragmoceras ulrichi* Foerste. Cross-section of conch at top of phragmacone, showing size of siphuncle and of its passage through the septum. From Beech creek, near Mooney, Tennessee; in Hermitage member of the Trenton. Reduced to four-fifths of natural size. In U. S. National Museum. See also *pl. XXIII, fig. 2;* and *pl. XXIV, figs. 1A, 1B,* in this Journal.

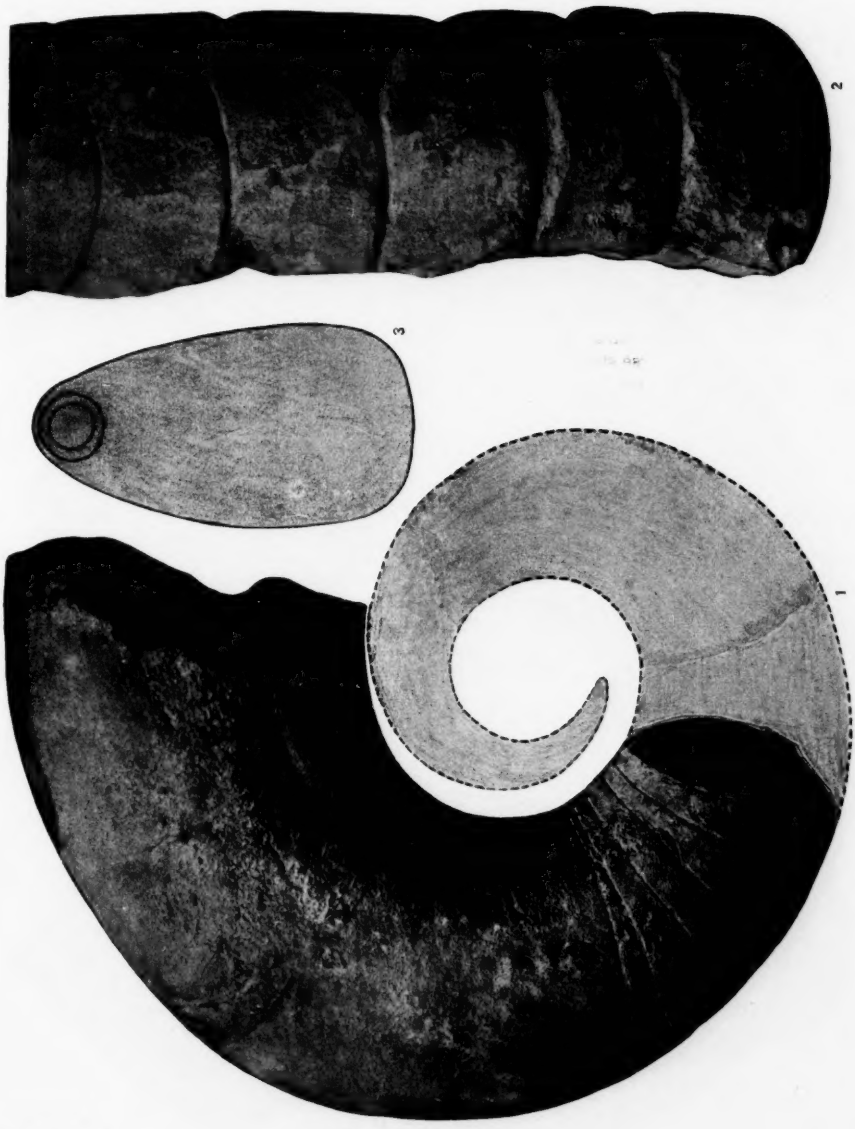

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PLATE IV

Fig. 1. *Uranoceras hercules* (Winchell and Marcy). A, ventral view, with part of the transverse striae accentuated so as to show their course better; B, lateral view of the same. From Chicago, Illinois, in the Racine dolomite. Figure reduced to nine-tenths of the natural size. No. 22933, at the University of Chicago. See also *pl. VII, fig. 2;* and *pl. VIII, fig. 4* in this Journal.

Fig. 2. *Uranoceras uranum* (Barrande). A, lateral view; B, cross-section of the specimen represented by fig. 2B on Pl. I, at the point indicated by a straight transverse line. In this cross-section the ventral or convex side of the conch faces upward. Figures reduced to three-fifths of natural size.

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PLATE V

Fig. 1. *Uranoceras hercules* (Winchell and Marcy). Lateral view, with the probable course of the missing apical part of the conch indicated. From Waukesha, Wisconsin; in the Racine dolomite. No. 2124, in the American Museum of Natural History. This specimen is the type of *Cyrtoceras* (*Phragmoceras ?*) *amplicorne* Hall. See also *pl. VIII, fig. 2* in this Journal.

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PLATE VI

Fig. 1. *Uranoceras dyeri* (Hyatt). A. lateral view, with some of the missing parts of the conch replaced by clay, which is darker in color than the rock; B, ventral view; the left side of the living chamber is not preserved; the course of the transverse striae is made clearer by accentuating part of these striae. From the vicinity of Chicago, Illinois, in the Racine dolomite.No. 2134, in the Museum of Comparative Zoology at Harvard University. See also *pl. VII, fig. 1* in this Journal. This specimen is the type of *Ancistroceras dyeri* Hyatt.

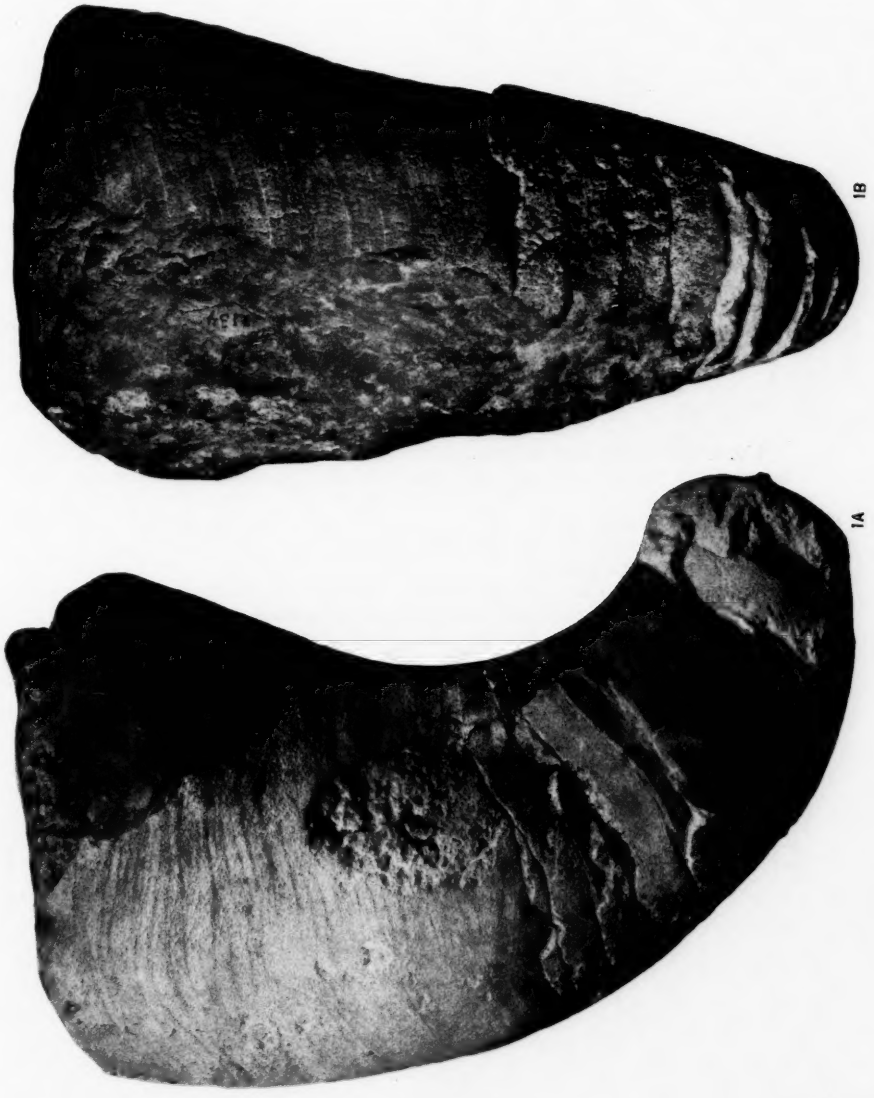

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PLATE VII

Fig. 1. *Uranoceras dyeri* (Hyatt). Lateral view of the type, with the probable course of the missing apical part indicated. Originally described as *Ancistroceras dyeri* Hyatt. See also *pl. VI, figs. 1A, 1B,* this Journal.

Fig. 2. *Uranoceras hercules* (Winchell and Marcy). Living chamber with probable course of the missing phragmacone. See also *pl. IV, figs. 1A, 1B;* and *pl. VIII, fig. 4* in this Journal.

Fig. 3. *Uranoceras uranum* (Barrande). Lateral view of same specimen as fig. 2A, on *pl. IV* of this Journal, with an attempt to indicate the probable course of the missing apical part. The septa are drawn as though taken from a dorso-ventral vertical section.

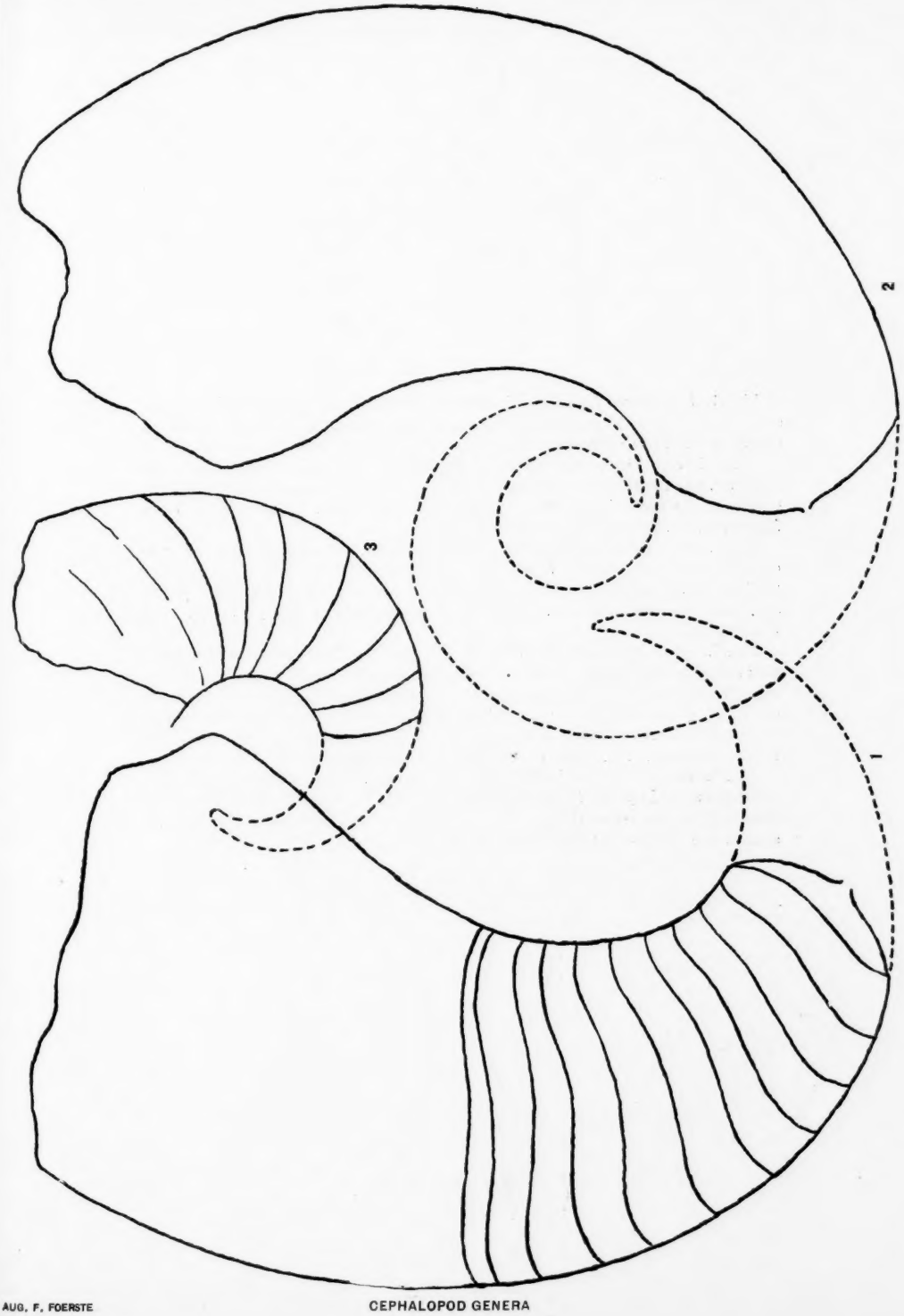

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PLATE VIII

Fig. 1. *Uranoceras hercules* (Winchell and Marcy). A, vertical dorso-ventral section through the phragmacone of the same specimen as *fig. 1,* on *pl. III,* based on exposures of two of the segments of the siphuncle. B, two cross-sections of the same specimen, of which the larger is taken 75 mm. above the base of the living chamber, and the smaller one is taken at the second camera above the base of the specimen; the latter locates the position of the siphuncle. In all cross-sections in this journal, the ventral side faces upward.

Fig. 2. *Uranoceras hercules* (Winchell and Marcy). Cross-sections of the type of *Cyrtoceras* (*Phragmoceras ?*) *amplicorne* Hall, of which the larger was taken at the base of the living chamber, and the smaller one was taken at the base of the specimen; the latter locates the position of the siphuncle. See *pl. V, fig. 1,* of this Journal.

Fig. 3. *Uranoceras hercules* (Winchell and Marcy). Cross-sections of a specimen not otherwise figured in this bulletin; of these, the larger was taken 50 mm. above the base of the living chamber, and the smaller one was taken at a distance of 1 small camera and 3 larger camerae below the base of this chamber; the smaller section locates the position of the siphuncle. From Hawthorne, Illinois, in the Racine dolomite. No. 22969, at the University of Chicago.

Fig. 4. *Uranoceras hercules* (Winchell and Marcy). Cross-sections of the specimen represented by *figs. 1A, 1B, on pl. IV;* see also *fig. 2,* on *pl. VII.* The larger cross-section was taken 110 mm. above the base of the living chamber, and the smaller one was taken at the base of this chamber.

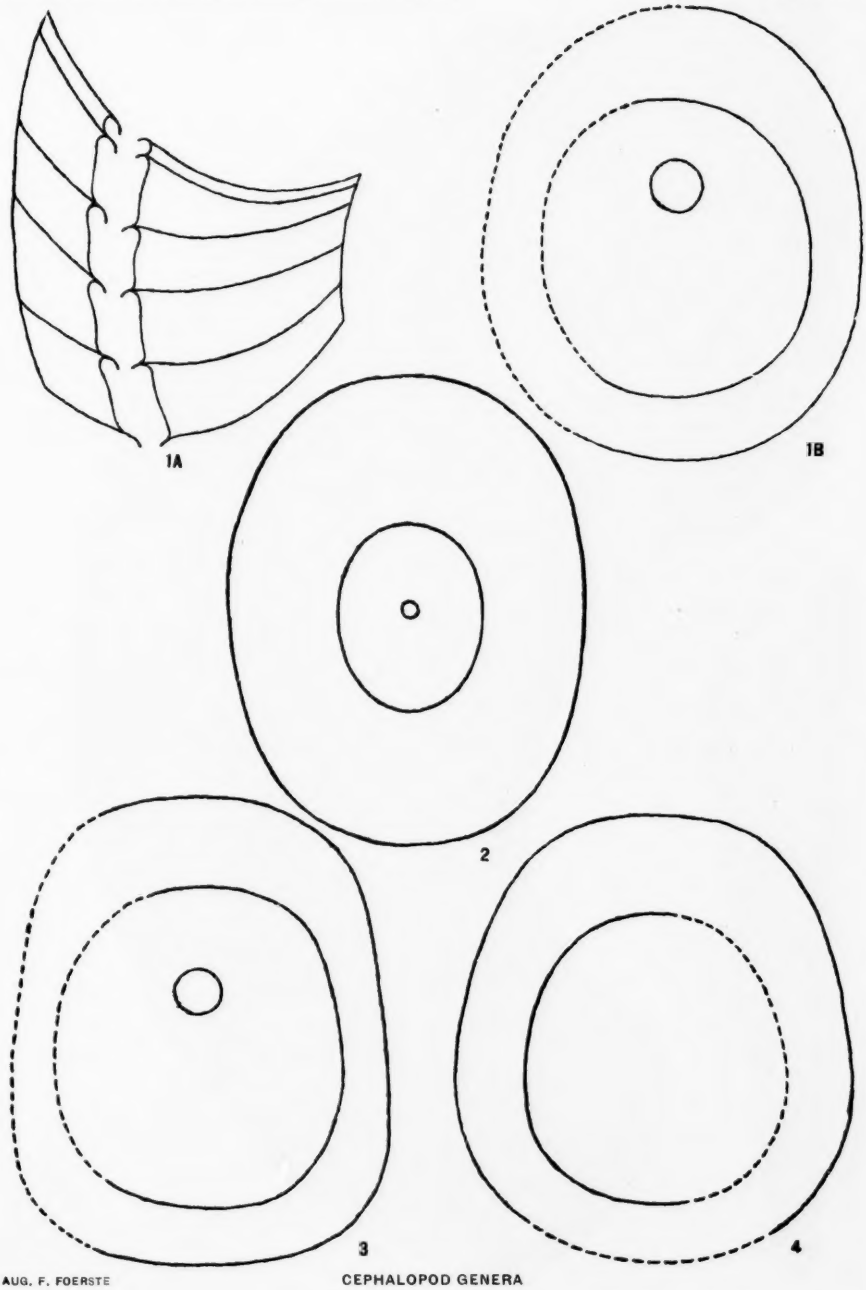

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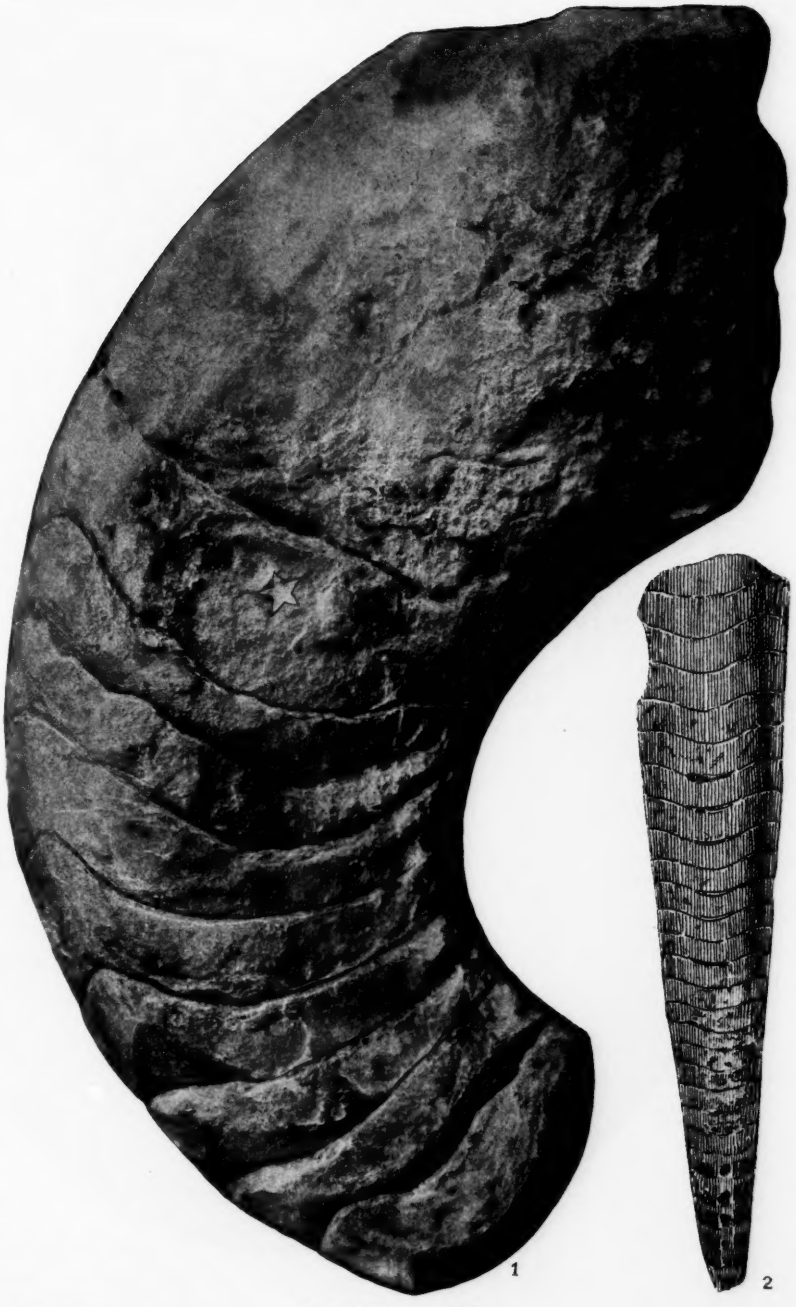
PLATE IX

Fig. 1. *"Nautilus" oceanus* (Hall). Lateral view, showing the ventro-lateral saddles. Figure reduced to three-fourths of the natural size. From Flat Rock creek, in Shelby county, Indiana; at the top of the Laurel limestone, in the Niagaran. No. 12329, in the New York State Museum. See also *pl. III, fig. 2;* and *pl. XVII, fig. 1* in this Journal.

Fig. 2. *Orthoceras* (*Loxoceras*) *breynii* Martin. Ventral view, showing the downward curvature of the sutures of the septa along the median parts of this side; the siphuncle, which is close to the ventral side of the conch, is exposed along the lower part. Copied from Martin, in *Petrefacta derbiensis*, 1809, pl. 39, fig. 4. The specimen is depressed dorso-ventrally, so that the siphuncle is located close to the surface of one of the flattened sides, and not centrally, as in *Orthoceras* (*Loxoceras*) *distans* M'Coy.



1 2

AUG. F. FOERSTE CEPHALOPOD GENERA

PLATE X

Fig. 1. *Gigantoceras cancellatum* (McChesney). Lateral view, taken from such a point of view that the transverse ribs or annulations along the more apical part of the conch are not seen readily. From Joliet, Illinois; in the Niagaran. No. 22968, at the University of Chicago. See also *pl. XVI, fig. 2;* and *pl. XVII, fig. 2,* in this Journal. Figure reduced to seven-eighths of natural size.

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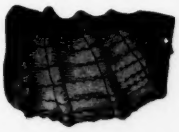
PLATE XI

Fig. 1. *Gigantoceras cancellatum* (McChesney). Lateral view, showing the transverse ribs along the ventral side of the apical part of the conch. From Bridgeport, in the southern part of Chicago, Illinois; in the Racine dolomite. No. 22863, at the University of Chicago. See also *pl. XVII, fig. 4*, in this Journal.

Fig. 2. *Cycloceras rugosum* (Fleming). Lateral view of apical end of a conch. Copied from Phillips, Geology of Yorkshire, 1836, pl. XXI, fig. 16, where it is described as *Orthoceras rugosum* Fleming, from Northumberland. Echinated character of ornamentation clearly shown.

Fig. 3. *Cycloceras* sp. Diagrammatic figure accompanying original description of genus *Cycloceras*, in M'Coy, Carb. Foss. Ireland, 1844, p. 6, fig. 6. A, lateral view; B, cross-section; both figures greatly enlarged to show resemblance to preceding figure.



2

3B

3A

1

AUG. F. FOERSTE

CEPHALOPOD GENERA

PLATE XII

Fig. 1. *Gigantoceras cancellatum* (McChesney). Lateral view, showing the smallest apical end seen so far; the initial part is still unknown. From Joliet, Illinois; in the Niagaran. No. 22028, at the University of Chicago. See also *pl. XVII, fig. 3*, this Journal.

Fig. 2. *Graftonoceras graftonense* (Meek and Worthen). A, lateral view; B, ventral view of part of this specimen, showing course of transverse ribs; C, approximate cross-section of part of the conch, with small crosses to indicate the location of the siphuncle, which is not exposed. From Grafton, Illinois, in the Niagaran. This is the type of the species. No. 2681, in the Illinois State Museum of Natural History.

Fig. 3. *Graftonoceras graftonense* (Meek and Worthen). A, lateral view; B, cross-section near larger end of conch. From Rising Sun, Ohio; in the Niagaran, at a horizon equivalent to the Cedarville dolomite. No. 7304, at Ohio State University.

Fig. 4. *Graftonoceras ortoni* (Meek). A, lateral view, showing part of exterior and part of interior of conch; evidently, most if not all of the of the former belongs to the living chamber. B, tranverse section at base of living chamber in fig. 4A. C, D, tranverse ribs along the ventral side of the specimen, at the points bearing the corresponding letters in fig. 4A. E, course of the sutures of the septa along the ventral side of the phragmacone. From Wilmington, Ohio; in the Cedarville dolomite. No. 7057, in Ohio State University.

Fig. 5. *Graftonoceras ortoni* (Meek). A, lateral view; B, cross-section of one of the whorls. From Greenville, Ohio; in the Cedarville dolomite. No. 3404, in Ohio State University. Type of *Lituites ? ortoni* Meek.

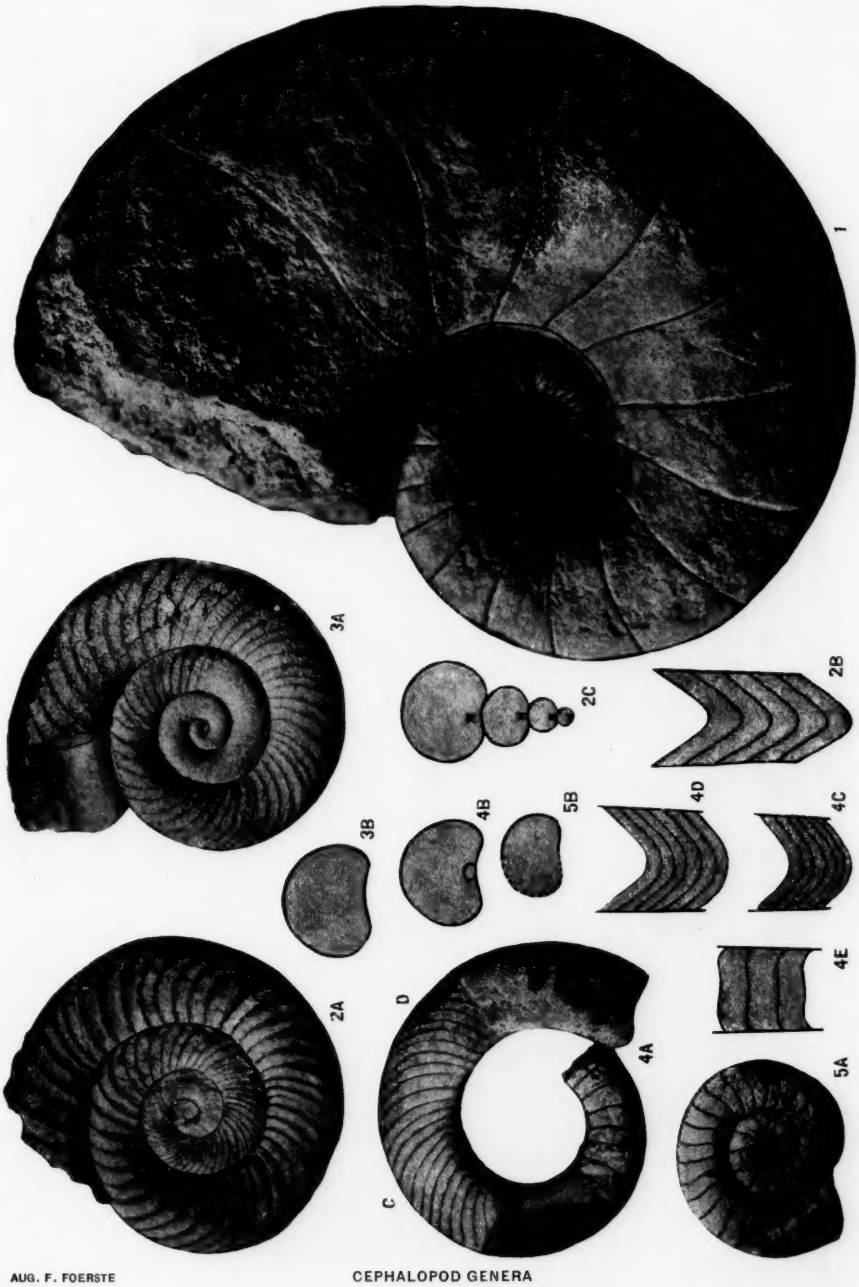


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PLATE XIII

Fig. 1. *Gigantoceras elrodi* (White). Lateral view, not preserving the apical end. From St. Paul, Indiana; at the top of the Laurel limestone, in the Niagaran. Type of *Gyroceras elrodi* White. No. 15006, in the University of Chicago. See also *pl. XIV, fig. 1;* and *pl. XVI, fig. 1.*

1

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PLATE XIV

Fig. 1. *Gigantoceras elrodi* (White). Dorso-ventral cross-section of conch, in which the septal funnel is preserved at the uppermost septum. Same specimen as that on *plate XIII*.

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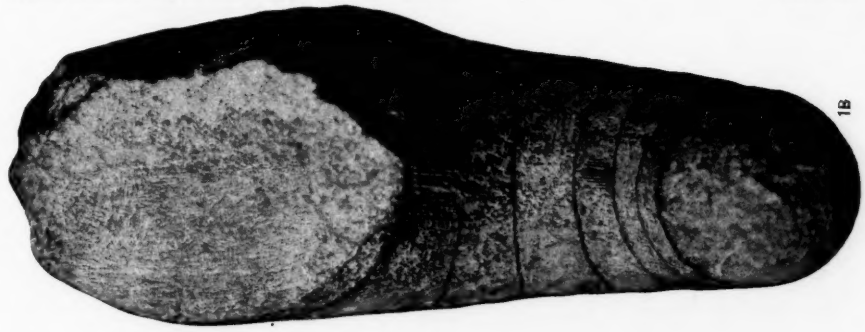
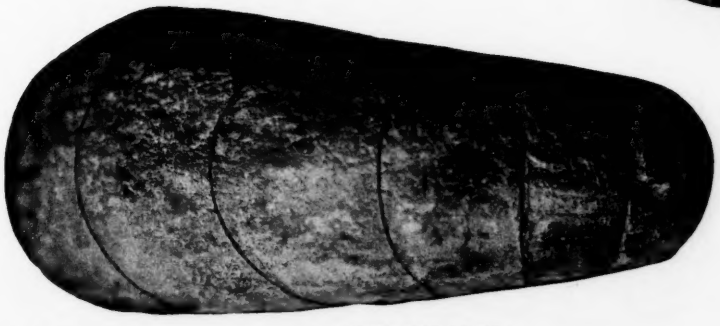
PLATE XV

Fig. 1. *Gigantoceras abruptum* (Hall). A, lateral view; B, dorsal view, with a trace of the vertical striae; C, ventral view. From Waldron, Indiana; at the top of the Laurel limestone, in the Niagaran. No. 11995, at the University of Chicago. See also *pl. XVI, fig. 3.*



1B

1A



1C

AUG. F. FOERSTE

CEPHALOPOD GENERA

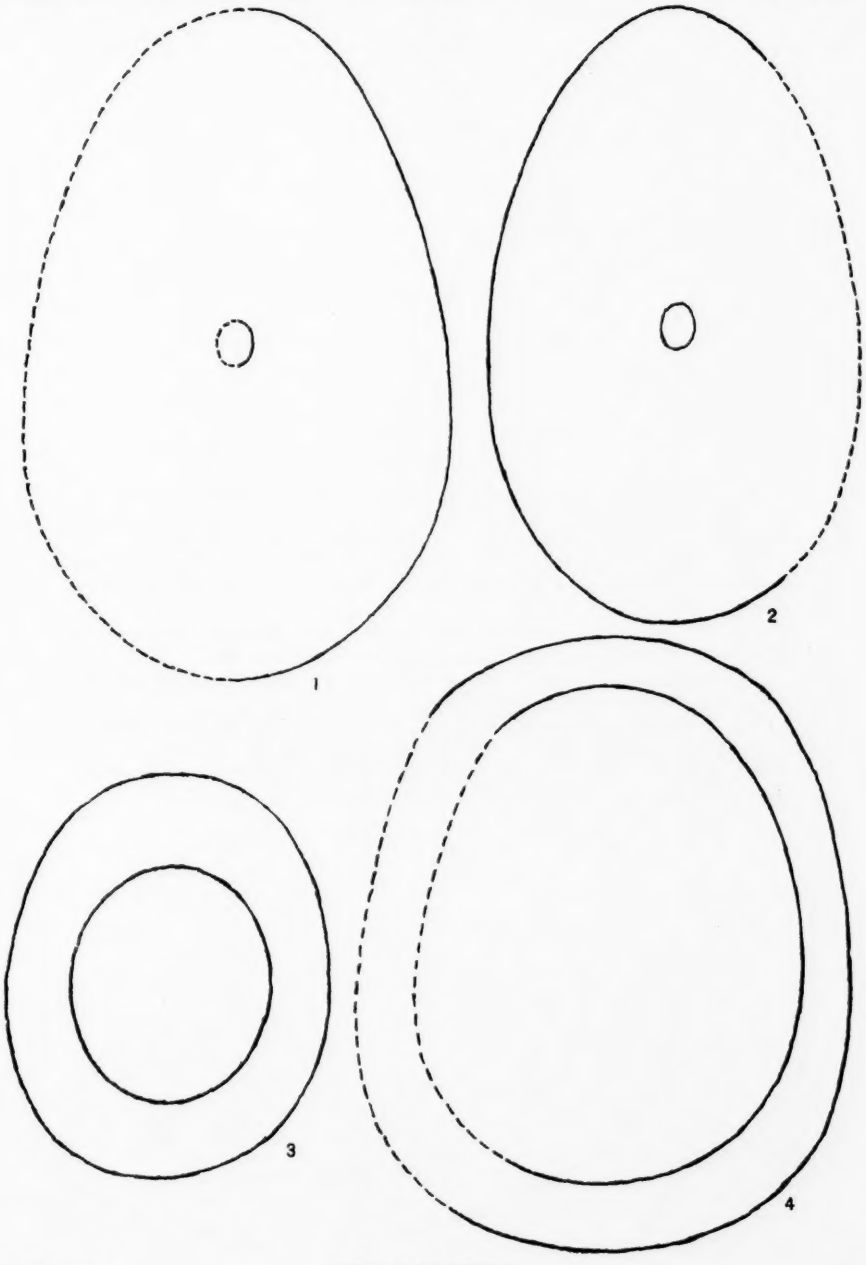
PLATE XVI

Fig. 1. *Gigantoceras elrodi* (White). Cross-section at larger end of specimen. Same specimen as that figured on *plates XIII and XIV*.

Fig. 2. *Gigantoceras cancellatum* (McChesney). Cross-section at upper end of phragmacone. Same specimen as that figured on *plate X*.

Fig. 3. *Gigantoceras abruptum* (Hall). Cross-sections, the larger one at top of phragmacone, the smaller one at base of specimen. Same specimen as that figured on *plate XV*.

Fig. 4. *Uranoceras hercules* (Winchell and Marcy). Cross-sections, the larger one 90 mm. above the base of the living chamber, the smaller one at the base of this chamber. From Waukesha, Wisconsin; in the Racine dolomite. Specimen described, but not figured otherwise. No. 22971, in the University of Chicago.



AUG. F. FOERSTE CEPHALOPOD GENERA

PLATE XVII

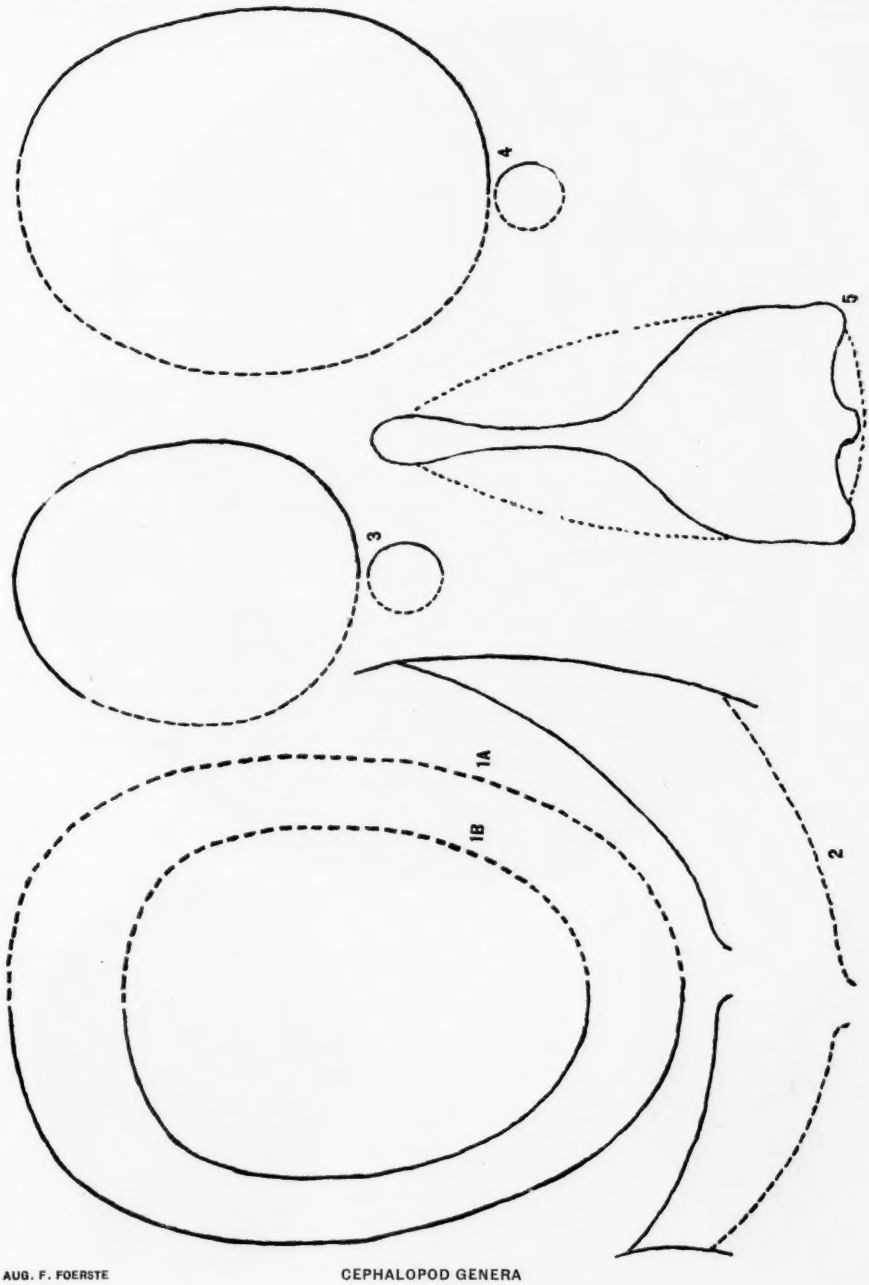
Fig. 1. *"Nautilus" oceanus* Hall. Two cross-sections, of which the larger one was taken at the base of the living chamber, and the smaller one was taken at the base of the specimen. Same specimen as that figured on *plates III and IX.*

Fig. 2. *Gigantoceras cancellatum* (McChesney). Vertical dorso-ventral section based on exposure of septal funnel at break near upper end of phragmacone of the specimen illustrated on *plate X.*

Fig. 3. *Gigantoceras cancellatum* (McChesney). Cross-section through two adjacent volutions of same specimen as that figured on *plate XII.*

Fig. 4. *Gigantoceras cancellatum* (McChesney). Cross-section through two adjacent volutions of specimen figured on *plate XI.*

Fig. 5. *Antiphragmoceras ulrichi* Foerste. View of top of living chamber, showing the outline of the aperature; the dotted line indicates the outline of the living chamber a short distance below the aperture. Same specimen as that illustrated on *pl. XXIII, fig. 2;* and *pl. XXIV, figs. 1A, 1B.*

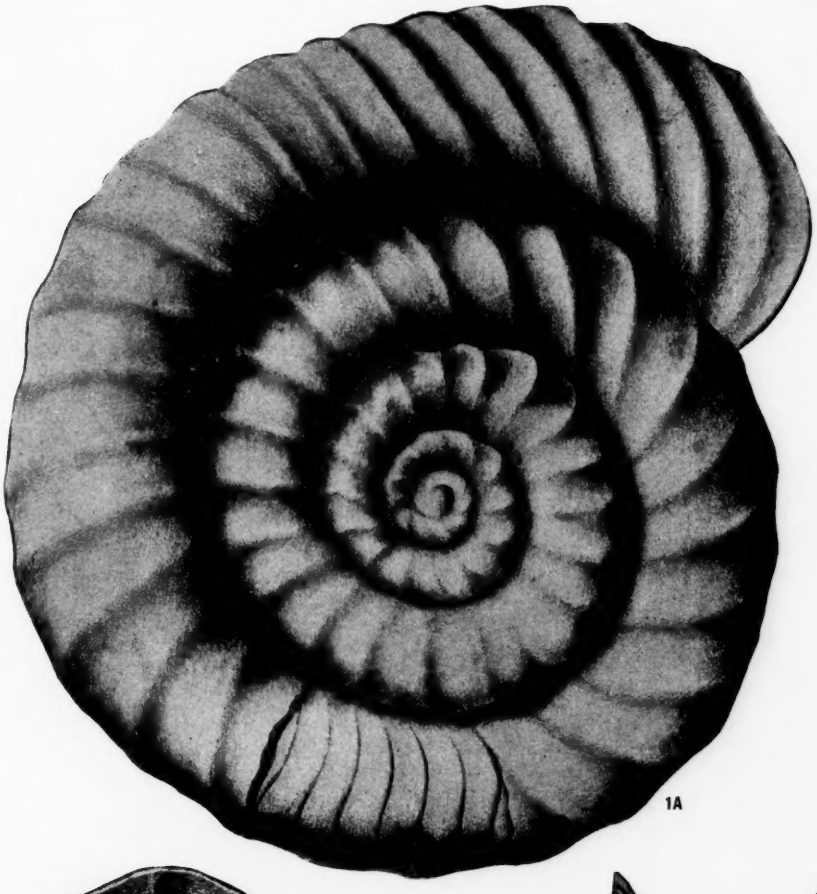


AUG. F. FOERSTE CEPHALOPOD GENERA

PLATE XVIII

Fig. 1. *Discoceras antiquissimum* (Eichwald). A, lateral view; B, ventral view showing the course of the transverse striae and folds or annulations. From the vicinity of Kertel on Dagö Island, in Baltic Russia, in erratic blocks belonging to the Kegel formation; regarded by Prof. Raymond as of Trenton age. Figures copied from Eichwald, Die Urwelt Russlands, 2, 1842, p. 33, pl. 3, figs. 16, 17.

Fig. 2. *Cyrtoceras depressum* Goldfuss. Dorsal view, showing a low and narrow median fold, bordered on each side by a shallow and narrow depression. The sutures of the septa rise strongly toward the ventral side of the conch on approaching the top of the phragmacone. The cross-section of the conch is sub-triagonal, the unpaired angle being along the median part of the ventral side. The siphuncle is close to the ventral wall of the conch; it is large, nummuloidal, and has actiniform vertical lamellae, as in the Actinosiphonata. From the Devonian of Gerolstein, in the Eifel of Germany. Genotype of *Cyrtoceras*.



1A

2

1B

AUG. F. FOERSTE

CEPHALOPOD GENERA

PLATE XIX

Fig. 1. *Bickmorites bickmoreanum* (Whitfield). Lateral view. From Wabash, Indiana, in the Niagaran. No. 22860, at the University of Chicago.

Fig. 2. *Bickmorites bickmoreanum* (Whitfield). A, cross-section, showing location of siphuncle; B, vertical dorso-ventral section, showing location of septal funnels. From type of *Lituites bickmoreanus* Whitfield. From Wabash, Indiana; in the Niagaran. No. 2131, in American Museum of Natural History.

Fig. 3. *Bickmorites bickmoreanum* (Whitfield). A, cross-section of a laterally compressed conch; B, dorso-ventral section. From Wabash, Indiana; in the Niagaran. No. 23101, at the University of Chicago. See also *pl. XX, fig. 1* in this bulletin.


2A
3A
2B
3B

1

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PLATE XX

Fig. 1. *Bickmorites bickmoreanum* (Whitfield). Lateral view of specimen not retaining the unannulated part of the living chamber, developed in its gerontic stage. From Wabash, Indiana; in the Niagaran, No. 23101, at the University of Chicago. See also *pl. XIX, fig. 3*. Reduced to nine-tenths of its natural size.

1

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PLATE XXI

Fig. 1. *Oxygonioceras* cf. *cuneatum* (Whitfield). A, lateral view; B, cross-section at base of living chamber; C, cross-section at base of specimen. From Wabash, Indiana; in the Niagaran. No. 22927, at the University of Chicago.

Fig. 2. *Bickmorites marshi* (Hall). A, lateral view; B, approximate cross-section through 3 of the volutions. From Kankakee, Illinois; in the Niagaran. Type of *Lituites Marshii* Hall. No. 2130, in the American Museum of Natural History.

Fig. 3. *Bickmorites marshi* (Hall). Vertical dorso-ventral section through the septal funnels of the siphuncle at third, fourth, and fifth camerae below the living chamber. From Joliet, Illinois, in the Niagaran. No. 22964, at the University of Chicago.

Fig. 4. *Bickmorites marshi* (Hall). Cross-section of a specimen similar to this species, found at Wabash, Indiana, in the Niagaran. No. 22934, at the University of Chicago.

AUG. F. FOERSTE CEPHALOPOD GENERA

PLATE XXII

Fig. 1. *Jolietoceras senescens* Foerste. A, lateral view, showing the oblique ribs which are most distinct ventrally; B, lower part of same specimen, illuminated so as to show the sutures of the septa better; the oblique ribs, on the contrary, are not visible under this illumination. From the Schoonmaker quarry, at Wauwatosa, Wisconsin, in the Waukesha dolomite, beneath the Racine. No. 2313, at Harvard university.

Fig. 2. *Jolietoceras senescens* Foerste. Two cross-sections; the larger one was taken at the third camera from the top of the specimen, the smaller one was taken at the fourteenth camera from the top. Same specimen as *pl. XXIII, fig. 1.*

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PLATE XXIII

Fig. 1. *Jolietoceras senescens* Foerste. Lateral view, with the probable course of the missing apical part indicated. From Joliet, Illinois, in the Niagaran. No. 22030 at the University of Chicago. See also *pl. XXII, fig. 2.*

Fig. 2. *Antiphragmoceras ulrichi* Foerste. Ventral view, showing some of the segments of the siphuncle, and the projecting lip at the hyponomic sinus. From Beech creek, near Mooney, Tennessee, in the Waynesboro quadrangle. In the U. S. National Museum. See also *pl. XXIV, figs. 1A, 1B.*

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PLATE XXIV

Fig. 1. *Antiphragmoceras ulrichi* Foerste. A, dorsal view, showing flattened dorsal side, and also the median and dorso-lateral sinuses of the aperture; B, lateral view, showing projecting lip at hyponomic sinus and the oblique lateral margin of the dorsal lobe of this aperture. From Beech creek, near Mooney, Tennessee, in the Waynesboro quadrangle. In the U. S. National Museum. See also *pl. XXIII, fig. 2; pl. XVII, fig. 5;* and *pl. III, fig. 3.*

Fig. 2. *Elrodoceras indianense* Miller. Vertical section through the siphuncle, showing the barrel-like outline of the segments of this siphuncle, and the septal funnels of the intermediate septa. This structure is closely similar to that of *Elrodoceras whitei* (Stokes) as outlined by Dr. F. A. Bather (Contributions from the Museum of Geology, University of Michigan, 2, No. 3, p. 63, fig. 2, 1924). See also Foerste, A. F., this Jour. 20, 228 (1924).

Fig. 3. *Ophidioceras Wilmingtonense* Foerste. Lateral view. From the Racine dolomite; probably at Wauwatosa, Wisconsin. No. 2273, at Harvard University; from the Day collection.

Fig. 4. *Ophidioceras Wilmingtonense* Foerste. A, lateral view; B, an enlarged cross-section, showing the concave band along the median part of the ventral side. From Yellow Springs, Ohio; in the Cedarville dolomite. No. 3405, at Ohio State University. Type of the species.

AUG. F. FOERSTE CEPHALOPOD GENERA

THE CORNELL UNIVERSITY ENTOMOLOGICAL EXPEDITION TO SOUTH AMERICA OF 1919-1920

Scientific Results. No. II. Hesperioidea

A. W. LINDSEY

Practically all of the material here discussed was taken by the expedition mentioned in the title. A small number of specimens were secured by purchase and gift, but in all cases these were taken within the region covered by the expedition. That so many small, obscure and scientifically interesting species are found in the lot is due chiefly to the diligence of Dr. W. T. M. Forbes. Although no individual record was kept, in most cases where no collector is mentioned, and this includes a vast majority of the specimens, the material was collected by him, with the exception of that from Brazil and Argentina. Only such collecting as this by experienced lepidopterists can bring our knowledge of the South American Hesperioidea, so rich in species and so baffling in phylogenetic relationships, to any point approaching completeness. Most professional collectors pay little attention to any but the more conspicuous forms, hence it is difficult to secure the small, dull colored species, although they are often of greater scientific interest. Their erratic and rapid flight makes them more difficult to catch and handle than other butterflies, and when once taken their commonplace appearance restricts their usefulness to the scientific field, hence we cannot logically expect valuable material from any but the truly scientific collector. The present lot is exceptional in this respect. In its thousand specimens of more than two hundred and fifty species Dr. Forbes has made a fine contribution to science. The opportunity to examine this collection has been a valuable privilege which I owe to Dr. Forbes and for which I thank him heartily.

Several factors make the identification of South American Hesperioidea, especially the more obscure Hesperiinae (Pamphilinae Auct.), a difficult and uncertain task. The numerous species described by Mabille and Plötz are among these factors, and the widely scattered descriptions by other writers are no less troublesome. In a family where poverty of characters for classification is in itself a serious obstacle, dependence upon the best of descriptions, and sometimes upon mediocre or poor figures is not reassuring. Godman and Salvin did much in the Biologia Centrali-Americana to make known such species as enter that region, and Godman's careful analysis of Plötz's unpublished figures is a great help in dealing with the unplaced species of that writer. Many of Mabille's species are known, and now that his collection has been united with that of the late M. Charles Oberthür in the possession of M. Rene Oberthür at Rennes there is probability that the rest will ultimately be made known. In the identification of this material I have succeeded in placing a a few species of Plötz and Mabille from the literature. I have also, before daring to describe new species, examined several of the important collections of this country, but with the greatest diligence possible one must still risk making synonyms in this family if he describes at all.

This material brings out no astonishing facts of a general nature, so far as can be deduced from the examination of the museum specimens. A considerable extension of the known range of species is indicated in a few cases, and several illustrate the remarkably wide distribution of species found also in North America. Several specimens belong to species known only from very limited material. A few, as *Urbanus titicaca* Rev. and *Pholisora mazans* Reak. have furnished information useful in determining the nature or rank of described forms.

Twenty-five new species and two new genera are described. The Biologia has been followed as a basis for arrangement, and in all cases where it was possible to place a new species even approximately in a genus already existing it has been done. The two new genera embody characters quite different from those of any others known to me. There are many points in this arrange-

ment which are not especially satisfying and certainly not final, but a more satisfactory classification awaits much more extensive studies of the South American fauna than have yet been made.

It is not my policy to express in a paper of this kind any revolutionary views on classification. In a number of cases, however, I have found the customary usage of generic names based on erroneous type fixations, and in most of these cases I have embodied the proper change in this report. The complete explanation of such changes will be found in a paper now in press which reviews all of the genera of Hesperioidea with their type fixations. In a few instances a determination of relationship between two genotypes is necessary to show whether one or both genera should stand, and the possible change is here avoided. Such unusual usage as is encountered in this report will therefore be fully explained in the above mentioned paper or in previously published studies of this family.

Before concluding I wish to express my thanks to Messrs. Wm. Schaus, Hugo Kahl and Wm. Gerhard, of the National, Carnegie and Field museums, respectively, for their kind coöperation in making available to me the resources of their institutions.

PYRRHOPYGINAE

Pyrrhopyge sergius Hopff.
San Ramon to Pueblo Pardo, Peru, June 17, 1 ♂, (J. C. Bradley).
Colony of the Perene, Peru, 1 ♂.

Pyrrhopyge papius Hopff.
Tambo Eneñas, Camino del Pichis, Peru, July 4, 1 ♂.
Mabille lists this species as a synonym of *P. gazera* Hew., an association which I am unable to verify.

Pyrrhopyge zeleucus Fab.
Diamantina, Brazil, Nov. 15, 1 ♀.

Pyrrhopyge fluminis Butl.
Colony of the Perene, Peru, 1 ♂.

Pyrrhopyge phidias Linn.
Puerto Bermudez, Rio Pichis, Peru, July 19, 1 ♂.
Iquitos, Peru, Mar. 9, 3 ♂, (Parish). Mar. 15, 1 ♀.
Hacienda No. 2, Col. Perene, Peru, June 8, 1 ♀.
Azupizu, Peru, July 8, 1 ♂.
Col. Perene, Peru, 1 ♂.

Pyrrhopyge passova Hew.
San Ramon to Pueblo Pardo, Col. Perene, Peru, June 17, 1 ♂.

Pyrrhopyge pelota Plötz.
Diamantina, Brazil, Nov. 16, 1 ♂.
Mysoria thasus Cram.
Near Tacna, Rio Putomayo, Peru, Aug. 28, 1 ♂.
Mysoria venezuelae Scud.
Taboga Is., Panama, Apr. 11, 2 ♂.
Posadas, Misiones, Argentina, Jan. 24, 1 ♂.
The Posadas specimen has the fringes much less broadly white, due to the fact that the basal scales are dark, while in the Panama specimens the white encroaches very slightly, both above and below, upon the wing itself. The genitalia are the same.
Sarbia xanthippe Latr.
Diamantina, Brazil, Nov. 15–16, 2 ♂.
This species and *spixii* Plötz are probably the same.
Sarbia damippe Mab. & Boull.
Diamantina, Brazil, Nov. 15, 1 ♂.
Jemadia azeta Hew.
Puerto Bermudez, Rio Pichis, Peru, July 19, 1 ♂.
Jemadia zonara Hew.
San Antonio, Peru, Aug. 12, 2 ♂.
Jemadia suzetta Mab. & Boull.
Puerto Bermudez, Rio Pichis, Peru, July 19, 1 ♂.
Iquitos, Peru, Aug. 5, 1 ♂.
Jemadia patrobas Hew.
Puerto Bermudez, Rio Pichis, Peru, July 17, 1 ♂.
El Campamiento, Col. Perene, Peru, July 4–7, 1 ♂.
I have before me five specimens, including the above two, which may be referred to three species on the basis of pattern as it is ordinarily used in the genus. They show a transition in the depth of bifurcation of the median band from zero to about ninety percent. The genitalia also vary in the slenderness or prolongation of the harpes, but all are of the same general shape as those of *patrobas* as illustrated in the *Biologia*.
Mimoniades periphema Hew.
Chanchamayo District, Peru, 1 ♂.
This specimen is rather larger than any in my series and has the white patches in the fringes of the secondaries almost completely obliterated.

URBANINAE

(Hesperiinae Auct.)

Goniurus simplicius Stoll
Near mouth of Trinidad River, Panama, Mar. 25, 2 ♂.
Taboga Is., Panama, Apr. 9, 1 ♂.
Chosica, Peru, May 3, 1 ♂, 1 ♀.
Lima, Peru, May 2, 1 ♂; May 5, 1 ♀; May 6, 1 ♀; May 7, 1 ♀; May 9, 4 ♂, 3 ♀; May 16, 1 ♂; May 21, 1 ♂, 1 ♀; May 2, 1 ♀.
El Campamiento, Col. Perene, Peru, June 8, 1 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂; July 16, 1 ♀.
Porto America, Rio Putomayo, Brazil, Aug. 30–Sept. 2, 1 ♀.

Goniurus eurycles Latr.

Hacienda No. 2, Col. Perene, Peru, June 8, 2 ♂.
El Campamiento, Col. Perene, Peru, June 8, 1 ♂, June 9, 1 ♂.
Hacienda San Juan, Col. Perene, Peru, June 16, 1 ♂.
San Ramon to Pueblo Pardo, Peru, June 17, 1 ♂.
Union de la Isla (Iquitos), Peru, Aug. 8, 1 ♀.
La Chorrera, Putomayo, Peru, Aug. 20, 1 ♀.
La Chorrera to La Sombra, Aug. 22, 1 ♂.
Kartabo, Bartica Dist., British Guiana, Oct., 1920, 1 ♀.
Port of Spain, Trinidad, Oct. 1, 1 ♂.

These two similar species appear from the data given above to overlap closely not only in appearance but also in distribution and season of flight.

Goniurus nivosus Plötz (Weymer i.l.)

El Encanto, Putomayo, Peru, Aug. 25, 1 ♂.

This species has points of similarity with *brachius* Hbn. and *doryssus* Swains. From the former it differs in the broader white marginal band on the secondaries below, suffused with fuscous toward the apex. In *brachius* the band itself is clear, though the fringes are marked with fuscous toward the apex; *brachius* also has fine sharp dark marginal dashes in this location which are lacking in nivosus. In *doryssus* the secondaries are shorter, the white band somewhat broader, and the brown discal area does not project sharply into the base of the tail. Mabille and Boullet list *nivosus* among their species of uncertain identity, and I have received one female from Staudinger and Bang-Haas as *brachius* together with correctly identified specimens of that species.

Goniurus orion Fab.

Hacienda San Juan, Col. Perene, Peru, June 16, 1 ♂.

Goniurus proteus Linn.

Lima, Peru, May 5, 1 ♂, 1 ♀; May 7, 1 ♂; May 9, 2 ♂.
El Campamiento, Col. Perene, Peru, June 4–7, 1 ♀; June 8, 1 ♂; June 11, 1 ♀; June 14, 3 ♀.
Hacienda No. 2, Col. Perene, Peru, June 8, 1 ♀.
Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂.
El Encanto, Putomayo, Peru, Aug. 25, 1 ♀.
Gastries, St. Lucia, Sept. 10–22, 1 ♀ (J. C. Bradley).
Bello Horizonte, Matto Grosso, Brazil, Nov. 3, 1 ♂, 1 ♀.

Goniurus undulatus Hew.

Hacienda de San Juan, Col. Perene, Peru, June 16, 1 ♂.
El Campamiento, Col. Perene, Peru, June 25, 1 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 18, 1 ♂.
Kartabo, Bartica, British Guiana, Oct., 1 ♂.
Tres Lagoas, Matto Grosso, Brazil, Dec. 7, 1 ♀.

The Guiana specimen is probably *nicasius* Plötz, referred to *undulatus* by Mabille and Boullet. Such differences as are present may easily be due to geographical distribution.

Goniurus octomaculatus Sepp.

Alta Parana River, Argentina, Jan. 23, 1 ♂.

Goniurus auginus Hew.

Iquitos, Peru, Mar. 15, 1 ♂.

Both Mabille and Boullet's and Godman and Salvin's works treat *auginus* as having four preapical spots. The former states also that the median group or band contains four, while Godman and Salvin are noncommittal on this point. Hewitson's description states that the primaries have six spots: "three in the form of a triangle in the center, and three before the apex." This agrees perfectly with the single male before me.

Goniurus hirtius Butler

Puerto Bermudez, Rio Pichis, Peru, July 16, 1 ♂.

Goniurus dorantes Stoll

Lima, Peru, May 2, 1 ♂; May 5, 2 ♂, 2 ♀; May 7, 1 ♀; May 9, 3 ♂, 1 ♀ May 16, 1 ♀.

El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 14, 1 ♂; June 19, 1 ♂; June 22, 1 ♂; June 25, 1 ♂; June 26, 1 ♂, 1 ♀; June 29, 1 ♂.

Azupizu, Camino del Pichis, Peru, July 8, 1 ♂.

Tambo Eneñas to Dos de Mayo, Camino del Pichis, Peru, July 5, 1 ♀.

Iquitos, Peru, Aug. 1, 1 ♂; Aug. 5, 1 ♀.

Port of Spain, Trinidad, Oct. 1, 2 ♂, 1 ♀.

Bello Horizonte, Minas Geraes, Brazil, Nov. 3, 1 ♀.

Goniurus santiago Lucas

Gastries, St. Lucia, Sept. 10–22, 2 ♂, 1 ♀ (J. C. Bradley).

Roseau Valley, Dominica, Nov. 18, 1 ♂, 1 ♀.

The Santa Lucia specimens particularly and the others to a lesser degree are very lightly spotted, one having only two tiny preapical points and another, scarcely visible, between R_3 and Cu_1.

Chioides catillus Cramer.

Darien, Panama, Mar. 3, 1 ♂.

Huacapistana, Rio Tarma, Peru, June 1–2, 2 ♂.

El Campamiento, Col. Perene, Peru, June 20, 1 ♂.

This species is closely related to *albofasciatus* Hew. Whether they should be separated from the genus *Goniurus* in which they are included by most writers is a question which can be answered only by thorough study of the tailed species. As expressed in my establishment of the genera *Chioides* and *Codatractus* I believe the tails to be characters which have appeared simultaneously in several phylogenetic lines.

Codatractus alcaeus Hew.

Puerto Bermudez, Rio Pichis, Peru, July 17, 1 ♂.

Codatractus imalena Butl. Pl. xxviii, fig. 4

Yurimaguas, Peru, Mar. 23, 2 ♂ (Parish).

Phocides pygmalion Cram.

Puerto Bermudez, Rio Pichis, Peru, July 12, 1 ♂; July 14, 1 ♀.

Puerto Alfonso, Rio Putomayo, Peru, Aug. 14, 1 ♂.

The female has a long blue stripe on each side of the anal vein of the primaries. In both males these stripes are interrupted by a whitish stripe set more obliquely, running from the base of the vein almost to the middle of the inner margin in one and not quite so far in the other.

Phocides distans H.-S.
Yurimaguas, Peru, June 28, 1 ♂ (Parish).

Phocides tophana Plötz
One specimen, a male, taken on Dec. 6. The locality is unfamiliar to me and I have been unable to locate it in any atlas or gazetteer. It is hastily written and possibly I have read it incorrectly.

Spathilepia clonius Cram.
Puerto America, Rio Putomayo, Brazil, Aug. 30–Sept. 2, 1 ♂.

Epargyreus exadeus Cram.
Puerto Bermudez, Rio Pichis, Peru, July 12–19, 13 ♂; July 14, 1 ♂.
Col. Perene, Peru, 1 ♂.
Itapura, Matto Grosso, Brazil, Dec. 6, 1 ♂.
Ilha Secca? ?; Dec. 6, 1 ♂.

Epargyreus enispe Hew.
Tres Lagoas, Matto Grosso, Brazil, Dec. 2, 1 ♂.

Epargyreus talus Cram.
El Campamiento, Col. Perene, Peru, June 18, 1 ♀ (Williamson).
I feel that Watson was right in referring this species to *Epargyreus*, and that it is incorrectly placed with *coelus* in the *Biologia*.

Proteides idas Cram.
Puerto Bermudez, Rio Pichis, Peru, July 19, 1 ♂.
Itapura, Matto Grosso, Brazil, Dec. 9, 7 ♂.

Polygonus amyntas Fab.
Alta Parana River, Argentina, Jan. 23, 3 ♂, 1 ♀.
Puerto Bermudez, Rio Pichis, Peru, July 12, 1 ♀.
Itapura, Matto Grosso, Brazil, Dec. 6, 1 ♂; Tres Lagoas, Dec. 7, 1 ♀.
Most of these are more distinctly banded below than North American specimens and have the dark basal spot on the under surface of the secondaries much larger. The Peruvian female is darker and more purplish, with the basal spot greatly reduced.

Physalea vulpecula Plötz, Pl. xxviii, fig. 2
El Campamiento, Col. Perene, Peru, June 18, 1 ♂.

Telegonus anaphus Cram.
Iguassu Falls, Argentina, Jan. 22, 1 ♂ (Parish).
El Campamiento, Col. Perene, Peru, June 8, 1 ♂.
Roseau, Dominica, Nov. 18, 1 ♀.
The one West Indian female appears to have no yellow on the upper surface and only a faint pale suffusion beyond the outer transverse band on the lower surface. It is in rather poor condition with the anal angle of each secondary broken, so that the point cannot be accurately judged, and in other particulars it agrees well with the males.

Telegonus anausis Godman and Salvin
Chosica, Peru, May 3–4, 1 ♂.
Lima, Peru, May 16, 2 ♂.

Telegonus fulgerator Walch
Iquitos, Peru, Feb. 27, 1 ♂ (Parish).
Near River Trinidad, Gatun Lake, Panama, Mar. 25, 1 ♀.
El Campamiento, Col. Perene, Peru, June 4–7, 1 ♀; June 9, 1 ♂.

Hacienda No. 2, Col. Perene, Peru, June 16, 1 ♀.
Kartabo, Bartica Dist., British Guiana, Oct., 1 ♀.
Lassance, Minas Geraes, Brazil, Nov. 12, 1 ♂.

Nascus euribates Cram.

Santa Pablo, Peru, Feb. 22, 1 ♀ (Parish).

Although the body of this specimen is almost destroyed, the wings are in fair condition. It shows certain definite characteristics which lead me to place it without doubt as the species figured by Cramer. I believe also, after studying this specimen in comparison with a male of *hesus* Westw. & Hew. that the two are very probably sexes of the same species, as has been suggested before. Proof must, of course, await the taking of both sexes together.

Nascus caepio H.-S.

El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂.

Bungalotis midas Cram.

Chanchamayo Dist., Peru, 1 ♂ (Señor Valle Riestra).

Cecropterus aunus Fab.

El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 29, 1 ♂.

Cecropterus capys G. & S.

El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 10 ,4 ♂; June 18, 1 ♂; June 19, 2 ♂.
Rio Haya, Peru, Aug. 6, 1 ♂.

Cecropterus itylus Hbn. Pl. xxvii, fig. 6

La Chorrera, Putomayo Dist., Peru, Aug. 20, 3 ♀.
La Chorrera to La Sombra, Peru, Aug. 21, 1 ♂.
Kartabo, Bartica Dist., British Guiana, Oct. 1 ♀.
Diamantina, Brazil, Nov. 15, 1 ♂.

Cecropterus lunulus Plötz?

El Campamiento, Col. Perene, Peru, June 9, 1 ♂.

This specimen fits Plötz's meager description as well as may be determined, and agrees with Mabille and Boullet's treatment of the species. It is too badly broken, however, for positive identification.

Cogia calchas H.-S.

San Juancito —, Feb. 27, 1 ♀.
Ancon, Panama, Mar. 20, 3 ♂.
Sabana, Panama, Mar. 21, 1 ♂.
Old Panama, Mar. 23, 3 ♂, 1 ♀.
Darien, Panama, Mar. 31, 1 ♀.
Sabana to Old Panama, April 3, 1 ♂.
Taboga Is., Panama, Apr. 11, 1 ♀.
Port of Spain, Trinidad, Oct. 1, 1 ♀.

Aethilla echina Hew.

El Campamiento, Col. Perene, Peru, June 8, 1 ♂.

This specimen appears in all respects to be referable to *echina*, but the lower terminal angle of the harpes is more attenuate than in Godman and Salvin's figure of the genitalia. The difference seems to be due to intraspecific variation.

Aethilla eleusinia Hew.

El Campamiento, Col. Perene, Peru, June 14, 1 ♀.

This is certainly the *eleusinia* of Mabille and Boullet (Essai de Revision pt. 3, p. 199, 1916) but unfortunately Hewitson's original description does not mention distinctive features.

Ancistrocampta? pertica Plötz (Weymer i. l.) Pl. xxv, fig. 3.

El Campamiento, Col. Perene, Peru, June 29, 1 ♀.

This species and *clearchus* are congeneric insofar as may be determined without the examination of a male.

Ancistrocampta? clearchus Plötz. Pl. xxv, fig. 1; pl. xxviii, fig. 8.

Puerto Bermudez, Rio Pichis, Peru, July 18, 1 ♂, 1 ♀.

This species is generally identified in collections as *hiarbas* Cram. It differs very evidently from Cramer's figure and can hardly be the same species even if allowance is made for the poor quality of this figure. Until I can examine specimens of true *hiarbas*, the genotype, I cannot say whether or not *pertica* and *clearchus* belong in this genus.

Lignyostola lacydus Druce

Near mouth of Trinidad River, Panama, Mar. 25, 1 ♂.

Lignyostola crinisus Cram.

Ancon, Panama, Mar. 21, 1 ♂.

Mouth of the Rio Teffé, Rio Solimões, Brazil, Sept. 5, 1 ♀.

Hyalothyrus neleus Linn.

Near River Trinidad, Gatun Lake, Panama, Mar. 25, 1 ♀.

Entheus peleus Linn.

Iquitos, Peru, Mar. 11, 1 ♂ (Parish).

El Encanto, Putomayo Dist., Peru, Aug. 28, 1 ♂.

Kartabo, Bartica Dist., British Guiana, Nov., 1 ♂.

The Iquitos specimen has the preapical spots and median band confluent in the costal area, and the inner margin of the median band more irregular. Its genitalia, however, compare well with a specimen from my collection which resembles the others.

Grynopsis coeleste Westw. & Hew.

Iquitos, Peru, Mar. 15, 1 ♂ (Parish).

Quadrus cerialis Cram.

Iquitos, Peru, Mar. 15, 1 ♂.

El Campamiento, Col. Perene, Peru, June 10, 1 ♂.

Kartabo, Bartica Dist., British Guiana, Oct., 1 ♂.

Quadrus difficilis Weeks

El Campamiento, Col. Perene, Peru, June 24, 1 ♂.

Pythonides paterculus form *deflorata* Draudt is a synonym of this name. The genitalia of the one specimen resemble the figure of the genitalia of *zera* (*paterculus*) given in the *Biologia* (pl. 82, f. 16), but the complete absence of blue from the under surface of the secondaries seems an ample specific character. It has been proved repeatedly that different species may have similar genitalia.

Quadrus noctis n. sp. Pl. xxv, fig. 4; pl. xxvii, fig. 12.

Expanse of type 29 mm.

Velvety blackish brown above. Under surface paler. Palpi and one side of legs with some buff scales.

Wings similar in color. Along costal region of primaries almost to apex, broadly around end of cell, and thence narrowly to inner margin is a diffuse pale gray-brown area containing a few scattered ochreous scales. The dark color beyond forms a terminal band of even width except at apex, where it broadens along costa. The secondaries show an extremely faint indication of a continuation of the pale subterminal line, marked with a very few pale scales only at its anterior end.

Under surface dark gray-brown. Secondaries with scattered ochreous scales forming a few vague pale blotches in the basal area, a bar across end of cell, and an even less distinct subterminal macular band. Fringes concolorous.

Holotype ♂, El Campamiento, Col. Perene, Peru, June 26, 1920. Cornell University.

The most distinctive feature of this dull insect is the peculiar appearance of the pale areas of the primaries. These look much as if they had been caused by pinching the two wings together, but examination under a lens shows that this is not the case.

Quadrus pelopea G. & S.

Port of Spain, Trinidad, Oct. 1 ♂.

Although it is impossible to check this identification by an examination of the genitalia, which are not figured by Godman and Salvin, the single specimen agrees so well with the original description and figure that it can scarcely be doubted. The species is not included in Kaye's catalogue of the butterflies of Trinidad nor in his supplement. Godman and Salvin give Mexico, the Amazon valley and Brazil as its distribution.

Gorgopas chlorocephala Latr.

Puerto Bermudez, Rio Pichis, Peru, July 18, 1 ♂.

Pellicia tiphys G. & S.

Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂.

Pellicia inca n. sp. Pl. xxv, fig. 6; pl. xxviii, fig. 5.

Expanse of type 32 mm.

Rich blackish brown. Under surface more grayish. Palpi grayish, due to a mixture of light and dark scales. Antennae paler gray, brown below.

The only conspicuous feature of the wings is a row of three small hyaline white preapical points in the usual position. Both wings are paler dull brown beyond the cell, with a subterminal vague broken band through the pale area. Remainder of wings rich velvety blackish brown, interrupted on the primaries by two vague pale bars from costa to hind margin of cell and on secondaries by a bar across end of cell to the first anal. Color below paler. Primaries with inner margin lighter than rest of wing, spots repeated. Secondaries with subterminal dark band repeated, preceded by a thicker vague macular discal band, both merging costad into a dark area. Fringes and secondary sexual tuft concolorous.

Holotype ♂, Puerto Bermudez, Rio Pichis, Peru, July 16, 1920, Cornell University.

In the Carnegie Museum are specimens from the Godman collection whose genitalia, superficially examined, resemble those of this specimen. The series stands under the name *bessus* Mösch. = *sordidulus* Mab. The type of *inca* is certainly not *bessus*. Whether the synonymy of that species and *sordidulus* is correct or not I cannot say. *Inca* is near *tiphys* G. & S., a specimen of which was taken at the same locality. The genitalia were unfortunately broken in mounting; the broken edges are indicated in the figure by dotted lines.

Pellicia macareus H.-S.

Puerto Bermudez, Rio Pichis, Peru, July 12–19, 1 ♂.
Union de la Isla (Iquitos), Peru, Aug. 8, 1 ♂.
El Oriente, Putomayo Dist., Peru, Aug. 18–19, 2 ♂.

Pellicia nyctimene Butler

Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂; July 17, 1 ♂; July 19, 2 ♂.
Upper Rio Pachitea, Peru, July 21, 1 ♂.
Iquitos, Peru, Aug. 6, 1 ♂.

Pellicia bromias G. & S.

El Campamiento, Col. Perene, Peru, June 10, 1 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂.
Bello Horizonte, Minas Geraes, Brazil, Nov. 14, 1 ♂.

Pellicia nivonicus Plötz

Gurupa, Brazil, Sept. 12, 1 ♂.
Souza, Para, Brazil, Sept. 16, 1 ♂.

These specimens and one in my collection from Coryaba, Brazil, are almost identical with Godman and Salvin's figure of *P. didia* ♀ (*Biologia* pl. 83, fig. 22–23) but differ in having the submarginal band of the primaries definitely broken up into spots, as Plötz says is true of *nivonicus* (Jahrb. Nass. Ver. xxxvii, 14). Godman (Ann. Mag. Nat. Hist. (7), xx, 136) clearly indicates the resemblance of Plötz's figure of *nivonicus* to *didia* ♀ so there can be little if any doubt that this is Plötz's species. These males lack the scale tuft which is characteristic of the genus *Pellicia*, but this, as a secondary sexual character, is regarded by most specialists in the family as insufficient for generic separation.

The type locality of *nivonicus* is given by Plötz as Mexico, but the range thus indicated is not exceptional among related forms.

Pellicia licisca Plötz?

El Campamiento, Col. Perene, Peru, June 15, 1 ♂.

The genitalia of this specimen have the left valve apparently broken, so that the complete form cannot be made out. The species is certainly closely allied to *thyestes* G. & S., which stands in the National Museum with *melcheri* Weeks in synonymy with *licisca*. The one specimen at hand is in poor condition.

Mycteris cambyses Hew.

Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂.

Cyclosemia anastomosis Mab?

Kartabo, Bartica, British Guiana, Oct., 1 ♀.

This specimen is very small, expanding only 28 mm., but it is like normal *anastomosis* in all other respects.

Cyclosemia subcaerulea Schaus

El Encanto, Putomayo Dist., Peru, Aug. 25, 1 specimen, broken.

Anastrus corbulo Cram. Pl. xxvii, fig. 2.

Hacienda San Juan, Col. Perene, Peru, June 16, 1 ♂.

Azupizu to Miriatiriani, Camino del Pichis, Peru, July 9, 1 ♂.

These specimens are *corbulo* according to material in the Carnegie Museum from the Godman collection. A number of species fit Cramer's figure fairly well.

Anastrus obliqua Plötz. Pl. xxv, fig. 8.

Dos de Mayo, Rio Ucayali, Peru, July 25, 1 ♀.

A rare species. Godman mentions one specimen from Santarem in his notes on Plötz's figures, but I have seen only the one now before me. It agrees very closely with Plötz's diagnosis.

Echelatus luctuosus G. & S.

Kartabo, Bartica Dist., British Guiana, Oct., 1 ♀.

Celaenorrhinus eligius Cram.

Taboga Is., Panama, Apr. 11, 1 ♂.

Chanchamayo Dist., Peru, 1 ♀.

Mylon lassia Hew.

Puerto Bermudez, Rio Pichis, Peru, July 17, 1 ♂.

Eudamidas melander Cram.

Lassanvira (spelling and country?), Jan. 2, 2 ♂.

Alta Parana River, Argentina-Paraguay, Jan. 23, 4 ♂.

El Campamiento, Col. Perene, Peru, June 25, 1 ♂.

Azupizu, Camino del Pichis, Peru, July 8, 1 ♂.

Puerto Bermudez, Rio Pichis, Peru, July 13, 16, 17 and 18, 5 ♂.

Chanchamayo Dist., Peru, 1 ♂ (Senor Valle Riestra).

Eudamidas cajus Plötz. Pl. xxvii, fig. 3.

Tambo Eneñas to Dos de Mayo, Camino del Pichis, Peru, July 5, 1 ♂.

This species might easily be taken for *melander* but it has no oblique spot beyond the middle of the cell of the primaries and is less sharply marked. *Obscurior* Schaus seems to be a synonym.

Eudamidas ozema Butl. Pl. xxvii, fig. 1.

Puerto Bermudez, Rio Pichis, Peru, July 14, 1 ♂.

The male genitalia figured in the *Biologia* under this name (pl. 85, fig. 17) are not the same as those of the specimen at hand, which are figured on plate xxvii. I have examined specimens in the Carnegie Museum and a long series in the National Museum superficially, and find that in all cases the valves are similar to those of the Cornell specimen. There is obviously some confusion in identifications, but which genitalia belong to true *ozema* I cannot say. It is remotely possible that Godman and Salvin had *ozema* before them but figured the genitalia of an allied species.

Xenophanes tryxus Cram.

El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 10, 1 ♂.

Ouleus nigropicea Mabille and Boullet

El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 10, 3 ♂; June 26, 1 ♂.

Puerto Bermudez, Rio Pichis, Peru, July 12, 1 ♂.

Iquitos, Peru, Aug. 5, 1 ♂.

Ouleus protius Plötz?

San Juancito, Feb. 27, 1 ♀.

This specimen can be placed here only tentatively.

Sostrata leucorrhoa G. & S.

Taboga Is., Panama, Apr. 10, 1 ♂.

Paches styx n.sp. Pl. xxv, fig. 14; pl. xxvii, fig. 4.

Expanse of type 29 mm.

Velvety black with a faint purple tinge. The primaries are generally paler, of an elusive shade of dark violet-gray which leaves a sinuous macular band, broken behind on M_3 and Cu_1, of the deeper velvety shade. There is a similar vaguely limited subterminal band which blends into the outer margin at the apex. Inner margin also suffused with the dark shade, showing a faint suggestion of a dark spot about one-third from base. Fringes also dark. Secondaries immaculate. Under surface dull gray-brown, paler toward inner margins of wings. Primaries with a mere shadowy indication of the transverse band, secondaries with two slightly stronger diffuse discal bands fairly distinct before fold.

In the paratype in the National Museum the markings are even more obscure and suffused near the inner margin of the primaries than in the holotype.

Holotype ♂, Puerto Bermudez, Rio Pichis, Peru, July 13, 1920, Cornell University.

Paratype ♂, 60 miles up the Maroni River, French Guiana, U. S. N. M.

Paches trifasciatus n.sp. Pl. xxv, fig. 12, 13; pl. xxvii, fig. 9.

Expanse of type 35 mm.

Upper surface gray-brown, head with a white spot above each eye. Under surface whitish, second joint of palpi white.

Primaries light gray-brown with velvety blackish brown transverse bands. One is subterminal, formed of large vague spots in the spaces, the next sinuous, curving out beyond end of cell, in below it, and then slightly outward toward inner margin. The latter is also diffuse and vaguely macular. The third is very broad, passing through middle of cell and narrowing thence toward the inner margin. All are lost in the ground color on the costa and extend only to the anal vein. There is a single hyaline white dot between R_3 and R_4 in the outer margin of the middle band. All three bands are continued across the secondaries. The outermost is broader on these wings, the middle one a little narrower and more sharply defined. The third forms a basal patch. Its outer margin is slightly irregular but in general curved so that the adjacent pale area is of equal width throughout. Fringes concolorous.

The under surface is of a lustrous tawny gray shade, paler toward inner margins of wings; fringes darker. The two outer bands are faintly indicated, formed of vague lunules with their concavities outward. There is a vague indication of two discal spots in the median band of the primaries in addition to the one preapical dot. The first, between M_3 and Cu_1, is crescentic and subhyaline, the second lies between the cubitals and is strongly constricted at the middle but only very faintly marked. In the anal angle of the secondaries between the two anals there is a rounded spot of blackish brown, conspicuous against the pale ground color of the wing.

Holotype ♂, Pueblo Pardo, Colony of the Perene, Peru, June 12, 1920, Cornell University.

Paches geometrinus Feld.
Urucum, Corumba, Brazil, Dec. 27, 1 ♂.

Paches loxus Doub. & Hew.
Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂.

Paches radiatus Butl.
Western Amazon near Esperanza, Brazil, Aug. 9, 1 ♂.

Pythonides jovianus Cram.
El Campamiento, Col. Perene, Peru, June 19, 1 ♂.

Pythonides fabricii Hbn.
Iquitos, Peru, Feb. 10, 1 ♀ (Parish).

Pythonides lerina Hew.
El Campamiento, Col. Perene, Peru, June 9, 1 ♂.
Manaos, Brazil, Sept. 7–9, 1 ♂.

Achlyodes thraso Hbn.
El Campamiento, Col. Perene, Peru, June 10, 1 ♂, 1 ♀; June 11, 1 ♂.
Bello Horizonte, Minas Geraes, Brazil, Nov. 1–6, 1 ♂ (R. C. Harris).
Corumba, Matto Grosso, Brazil, Dec. 19, 1 ♂.

Achlyodes busirus Cram.
El Campamiento, Col. Perene, Peru, June 11, 1 ♂.
Pueblo Pardo, Col. Perene, Peru, June 12, 1 ♂.
La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♀.
Petropolis, Rio de Janeiro, Brazil, Oct. 26, 1 ♂.

Antigonus nearchus Latr.
Chanchamayo Dist., Peru, 1 ♂ (Senor Valle Riestra).
Puerto Bermudez, Rio Pichis, Peru, July 17, 1 ♂.

Antigonus erosus Hbn.
Taboga Is., Panama, Apr. 10, 1 ♂.
Minas Geraes, Brazil, Nov. 9, 1 ♂.
Urucum, Corumba, Brazil, Dec. 24, 1 ♀.

Systasea excisus Mab. Pl. xxvii, fig. 13.
Tambo Eneñas, Cam. del Pichis, Peru, July 4, 1 ♂.

Diaeus variegata Plötz.
Aconquija, Tucuman, Argentina, Feb. 24, 3 ♂ and 2 badly broken.
El Campamiento, Col. Perene, Peru, June 19, 1 ♂.

Ebrietas osyris Staud.
Yurimaguas, Peru, Mar. 25, 1 ♂.

Ebrietas anacreon Staud.
Alta Parana River, Argentina-Paraguay, Jan. 23, 1 ♂.
Yurimaguas, Peru, Mar. 25, 1 ♂.
Azupizu, Cam. del Pichis, Peru, July 8, 1 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 13, 17, 18, 19, 1 ♂ each.

Ebrietas infanda Butl. Pl. xxv, fig. 7; pl. xxviii, fig. 1.
Hacienda No. 2, Col. Perene, Peru, June 8, 1 ♂.
Tambo Eneñas, Cam. del Pichis, Peru, July 4, 1 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 19, 1 ♂.

Camptopleura theramenes Mab.
El Campamiento, Col. Perene, Peru, June 29, 1 ♂.
Rio Aguachini, Cam. del Pichis, Peru, July 11, 1 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 14, 16, 19, 4 ♂.
Lassance, Minas Geraes, Brazil, Nov. 10, 1 ♀.

Camptopleura impressa Mab. Pl. xxviii, fig. 6.
Puerto Bermudez, Rio Pichis, Peru, July 12, 1 ♂.
This species is referred tentatively to *Ebrietas* by Godman and Salvin, who note the absence of the costal fold. This character is hardly enough to warrant placing it in a different genus from the closely related *theramenes*.

Camptopleura sp.
Puerto Bermudez, Rio Pichis, Peru, July 12, 1 ♀.
This one specimen belongs either in this or a closely allied genus. It is rather worn, and is so lacking in distinctive characters that it seems inadvisable to describe it.

Helias phalaenoides Hbn.
Yurimaguas, Peru, Feb. 12, 1 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂.

Helias palpalis Latr.
Bello Horizonte, Minas Geraes, Brazil, Nov. 1–6, 1 ♂.

Gorgythion pyralina Hopff.
Hacienda No. 2, Col. Perene, Peru, June 8, 1 ♂.
Iquitos, Peru, Aug. 6, 1 ♂.
La Chorrera, Putomayo Dist., Peru, Aug. 20, 4 ♂, 2 ♀.

Anisochoria polysticta Mab.
Hacienda No. 2, Col. Perene, Peru, June 8, 1 ♂.
El Campamiento, Col. Perene, Peru, June 11, 1 ♂.
The hyaline spots on the primaries of these specimens are much smaller than in the figures given by Godman and Salvin in the *Biologia*.

Miltomiges cinnamomea H.-S. Pl. xxvii, fig. 8.
Petropolis, Rio de Janeiro, Brazil, Oct. 26, 1 ♂, (R. C. Harris).

Theagenes haematospila Feld.
Tambo Eneñas to Dos de Mayo, Cam. del Pichis, Peru, July 5, 1 ♂.

Theagenes albiplaga Feld.
Aconquija, Tucuman, Argentina, Feb. 24, 1 ♂.
Huacapistana, Rio Tarma, Peru, June 16, 1 ♂.

Pholisora cupreiceps Mab.
Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂.
This specimen has three small hyaline preapical spots, in which it disagrees with Godman and Salvin's figure (*Biologia* pl. 89, fig. 4, 5, 6). A specimen in my collection from Colombia also has preapical spots, but only two in number and very small. Since the genitalia of both agree with the last of the figures cited above, this seems to indicate pronounced variation in this character. I have noted such variation in a number of species of *Pholisora*, while in others there is apparently a marked degree of constancy in the occurrence of the preapical dots.

Pholisora oeta Plötz. Pl. xxvii, fig. 11.
Lassance, Minas Geraes, Brazil, Nov. 9–19, 1 ♂.

It will be noted that the genitalia of this specimen resemble those of *aurocapilla* Staud, as figured in the *Biologia* (pl. 89, fig. 11). The specimen is worn, unfortunately, but even allowing for the loss of many scales it can hardly have had the orange head and prothorax of Staudinger's species. It agrees with *oeta* of the National Museum collection.

Pholisora minor Schaus. Pl. xxv, fig. 10, pl. xxvii, fig. 5.

Hacienda No. 2, Col. Perene, Peru, June 8, 1 ♂.

Puerto Bermudez, Rio Pichis, Peru, July 13, 25 ♂.

This identification has been checked by an examination of the genitalia of the type in the National Museum, which Mr. Schaus very kindly permitted me to mount.

Pholisora mazans Reakirt. Pl. xxvii, fig. 7a, c and e.

Darien, Panama, Mar. 31, 1 ♀.

Sabana to Old Panama, Apr. 3, 1 ♂.

El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 10, 1 ♂.

Hacienda No. 2, Col. Perene, Peru, June 8, 2 ♂.

Puerto Bermudez, Rio Pichis, Peru, July 13, 3 ♂.

Hacienda San Juan, Col. Perene, Peru, June 16, 1 ♂.

Port of Spain, Trinidad, Oct. 1, 2 ♂.

In none of these specimens are the genitalia just like the figure given by Godman and Salvin in the *Biologia* (Pl. 89, fig. 14) and that recently published by Skinner and Williams (Trans. Am. Ent. Soc. xlviii, 300, fig. 20). All have a dorsal lobe on the valve, as shown in the figures. The variation in this lobe and in the heavy spines and their relation to it leads me to believe that we are dealing with a case of genitalic variation similar to that of *tessellata* and *occidentalis* of the North American fauna, and not with separate species. Reakirt's name taken precedence over *ascalaphus* Staudinger, by which the species is more commonly known. This fact was pointed out by Godman and Salvin in the supplement to the *Biologia*, p. 740.

Pholisora alicus Schaus?

Kartabo, Bartica, British Guiana, Oct., one broken specimen.

This specimen probably belongs to *alicus*, the type of which is from Castro, Paraná, Brazil. The comparison with Mr. Schaus' type was not, however, conclusive.

Pholisora undulatus Mab.

Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂; July 19, 1 ♂.

Mouth of the Rio Teffé, Rio Solimões, Brazil, Sept. 5, 1 ♂.

In one of these three specimens there is only a trace of the preapical spots, of which the middle one is lacking and the first and third tiny.

Pholisora philo Mab?

Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♂.

This specimen agrees with several so labelled in the National Museum but has two small white discal dots in addition to the three preapical. I have been unable to locate Mabille's description.

Pholisora atahuallpai n.sp. Pl. xxv, fig. 9; pl. xxviii, fig. 3.

Expanse: ♂ 32 to 34 mm.; ♀ 32 to 40 mm.

Brownish black above, with a few buff scales. Below more grayish brown, palpi with many pale scales. Antennae black, club and distal half of shaft pale below.

Wings brownish black with a few scattered buff scales, most numerous on the pale markings. The primaries have no costal fold in the male. They are crossed by a vague, slightly paler, subterminal band formed of diffuse spots between the veins. This is preceded by a vague dark band which contains two hyaline white preapical points in the spaces between R_3 and R_5. To these in one male and both females of the series is added a third in the space behind, slightly outside of the others. There is also a vague dark patch in end of cell. The secondaries have a vague pale terminal line, a subterminal macular band like that of the primaries which is joined, as in *mancoi*, outside of the cell by the posterior portion of a similar median band, and a pale bar at end of cell. None are conspicuous, but all are made fairly evident by a scattering of buff scales. Fringes concolorous.

Under surface similar in color, even, with all pale markings reproduced and somewhat more sharply defined by scattered buff scales. The secondaries are a little deeper in color and more velvety in the costal region and the pale marks here are not conspicuous, while basad, in the fold, and in the anal angle the pale scales are more numerous. In some specimens they define the pale marks behind the radial with moderate sharpness, while in others this entire area is suffused with them so that the spots merge more or less with the overscaling.

Holotype ♂ and two paratypes ♂, Puerto Bermudez, Rio Pichis, Peru, July 13, 1920 and paratype ♀, Pueblo Pardo, Colony of the Perene, Peru, June 12, 1920, Cornell University.

Paratype ♂, Puerto Bermudez, Rio Pichis, Peru, July 13, 1920 and paratype ♀, Porto America, Rio Putomayo, Brazil, Aug. 30–Sept. 2, 1920, in coll. Lindsey.

It is possible that the last specimen mentioned does not belong with the others, since the posterior preapical spot is not the smallest as in the case with the rest. The specimen is otherwise like those from Peru, however, so it is made a paratype without hesitation.

Pholisora mancoi n.sp. Pl. xxv, fig. 11; xxvii, fig. 10.

Expanse of type of 33 mm.

Upper surface brownish black with a few scattered ochreous scales on all parts, the pale scales more numerous below, especially on palpi. Antennae blackish, the club pale below.

Wings brownish black. Primaries with a short costal fold about two thirds as long as cell. Both pairs of wings are crossed by a vague subterminal band, slightly paler than the ground color, formed of spots between the veins, and are sparsely sprinkled with ochreous scales. The primaries have in addition three small hyaline white preapical points in the spaces from R_3 to M_1, decreasing in size in this order. On the secondaries the posterior portion of a discal band similar to the subterminal appears to join the latter beyond end of cell, as in the preceding species. All of these bands are very vague. Fringes concolorous.

Under surface similar in color. Posterior preapical dot of primaries lacking and subterminal band even more vague. Secondaries with a fairly conspicuous sprinkling of buff scales at base, along inner margin and anal angle, and on the posterior spots of both bands, which are thus rather distinct behind the cell although elsewhere as vague as on the primaries.

Holotype ♂, Puerto Bermudez, Rio Pichis, Peru, July 14, 1920, Cornell University.

This species is closely related to *P. atahuallpai*, and belongs to *Staphylus* or *Bolla* Auct. The genus *Pholisora* as treated here shows a marked degree of interspecific variation in almost all structures, and in the genitalia too we find a wide range of forms. I have demonstrated elsewhere that the variation is gradual, so that division into other genera becomes difficult. Here I may add that genitalic structure seems equally lacking as a basis for subdivision.

Pholisora cordillerae n.sp. Pl. xxv, fig. 5; pl. xxviii, fig. 7.

Expanse 26 to 27 mm.

Gray-brown. Under surface paler. Legs with inner side whitish. Palpi below with mixed whitish and gray scales, third joint more whitish.

Wings in general gray-brown with a purplish tinge which is more evident on the primaries. These wings have a dark patch extending from the costa across and partly outside of end of cell to M_3. Its outer and posterior margins are distinct but basad it blends into the paler ground color of the wing. From its basal angle on the posterior margin of the cell a patch of similar color extends along the cell to the second cubital, and from this as its costal margin it runs broadly to the anal vein with a concave outer margin. There is a rounded spot of the same shade in the cell. Before and beyond these dark areas the wing appears more grayish, but darkens again outwardly. This terminal dark area contains a subterminal, faintly paler, zigzag line, poorly defined, with faint dark shades from its outer points. There is a costal fold in the male which almost reaches the end of the cell. Secondaries with a subterminal band of vague pale spots between the veins and a vague pale discal band from radial to anal across end of cell. Fringes of mixed gray-brown and paler scales, appearing concolorous.

Under surface dull gray-brown, the secondaries slightly browner, the primaries becoming paler toward outer and inner margins. Primaries crossed by a subterminal row of vague pale spots in spaces. Secondaries with a more evident row of similar spots, also subterminal, and a few in the position of the discal band of the upper surface.

All types from Matucana, Peru, 8000 ft.

Holotype ♂, paratype ♂ and one other ♂, May 11; paratype ♂ May 27, and one ♂ May 12, Cornell University.

Paratype ♂ and one other ♂, May 11, in coll. Lindsey.

The depth of color and sharpness of contrast between the ground color and markings in this species vary greatly. The type series, quite naturally, is fairly uniform in these particulars, but specimens in the National Museum are very dark and obscurely marked.

Scantilla opites G. & S?

Corumba, Matto Grosso, Brazil, Dec. 16, 1 ♀.

The locality from which this specimen came is so remote from Dueñas, Guatemala, the type locality of the species, that I feel some hesitation in placing a single female thus. However it agrees so closely in all of its rather vague characters with Godman and Salvin's figures of the male that the interrogation is more a warning than an indication of doubt.

Zopyrion disrupta Mab. & Boull.

Lassance, Minas Geraes, Brazil, Nov. 9, 1 ♂.

This specimen had been set aside as different from *sandace* G. & S. and *satyrina* Felder, and compared with the figure of *chinoba* Weeks, which it resembled most closely, when, quite by accident, the description of *disrupta* was noticed. The specimen resembles Week's figure of *chinoba* very closely except that it lacks the heavy submarginal spots on the under surface of the secondaries which are so conspicuous in that figure. It differs from *sandace* chiefly in the more ochreous under surface of the primaries, and this is one thing which is said to characterize *disrupta*. The interruption of the bands on the wings which suggested the name *disrupta* is not conspicuous in comparison with true *sandace*. If valid, as I believe, I feel that the name should take specific rank.

Urbanus archia Dyar

Lima, Peru, May 2, 2 ♀; May 9, 2 ♀.

Matucana, Peru, 8000 ft., May 10 to 27, 26 ♂, 11 ♀.

Tarma, Peru, May 30, 1 ♀.

This beautiful species is related to *trisignatus* Mab. Elwes lists *Hesperia notata* var. *valdiviana* Reed under Mabille's species (Trans. Ent. Soc. Lond. 1903, p. 294), saying that a cotype in the British Museum "looks like a variety of the same species but may be distinct." Dyar's species may prove to be a synonym of one of these, but I am unable to decide this at present.

Urbanus syrichtus Fab.

Panama: near R. Trinidad, Gatun Lake, Mar. 25, 6 ♂, 2 ♀; Mar. 27, 1 ♀. Old Panama, Mar. 23, 1 ♂; Darien, Canal Zone, Mar. 31, 3 ♂, 1 ♀.

Peru: Lima, May 2, 1 ♂; Apr. 30, 2 ♂; Matucana, May 11, 1 ♂; Huacapistana, Rio Tarma, June 1–2, 1 ♀; El Campamiento, Col. Perene, June 4–7, 5 ♂, 1 ♀; June 10, 1 ♂; June 14, 1 ♀; Pueblo Pardo, Col. Perene, June 12, 1 ♀; Miriatiriani, Cam. del Pichis, July 8, 1 ♂; Puerto Bermudez, Rio Pichis, July 12, 1 ♂; July 19, 1 ♂; Iquitos, Aug. 5, 1 ♂.

Brazil: Manaõs, Sept. 7–9, 2 ♂; Gurupa, Sept. 12, 1 ♀; Souza, Parâ, Sept. 16, 1 ♀; Petropolis, Oct. 26, 1 ♂, 1 ♀; Bello Horizonte, Nov. 1–6, 1 ♂.

Kartabo, Bartica, British Guiana, Oct., 2 ♂, 3 ♀.

Port of Spain, Trinidad, Oct. 1, 1 ♀.

Gastries, St. Lucia, Sept. 10–22, 1910, 9 ♂, 6 ♀, (J. C. Bradley).

Roseau Valley, Dominica, Nov. 18, 5 ♂, 2 ♀.

Charlotte Amalia, Virgin Is., 3 ♂, 2 ♀.

Urbanus notata Blanch.

Old Panama, Mar. 23, 1 ♂.

Juan Mina, Canal Zone, Panama, Mar. 30, 1 ♂.

Darien, Canal Zone, Panama, Mar. 31, 2 ♂, 2 ♀.

Lima, Peru, May 1, 1 ♂, 1 ♀; May 2, 1 ♀; May 7, 1 ♀; May 9, 1 ♀.

Chosica, Peru, May 3–4, 3 ♀.

Matucana, Peru, 8000 ft. May 11, 1 ♂, 2 ♀; May 12, 1 ♀.

Corumba, Matto Grosso, Brazil, Dec. 15, 1 ♂; Dec. 20, 1 ♂.

Urbanus titicaca Reverdin (Bang-Haas i.l.)

Tarma, Peru, May 30, 2 ♂, 1 ♀.

This was described as *Hesperia notata* var. *titicaca* but I believe that it should rank as a distinct species.

Urbanus macaira Reakirt

Darien, Canal Zone, Panama, Mar. 30, 1 ♂, 1 ♀.
Corozal, Canal Zone, Panama, Apr. 7, 1 ♂.
El Campamiento, Col. Perene, Peru, June 28, 1 ♂.

Urbanus nivella Mab.

Diamantina, Brazil, Nov. 15.

The under surface of the secondaries in the one specimen taken is almost immaculate. I am inclined to believe that this will be found to be a pale form of *macaira*.

Urbanus domicella Erichson

Corumba, Matto Grosso, Brazil, Dec. 15, 1 ♂.

Urbanus arsalte Linn.

Panama: Sabana, Mar. 21, 1 ♂; near mouth Trinidad R., Mar. 25, 1 ♂; Ancon Hill, Mar. 30, 1 ♀; Darien, Canal Zone, Mar. 31, 2 ♂, 1 ♀; Taboga Is., Apr. 8, 1 ♂.

Peru: El Campamiento, Col. Perene, June 4–7, 5 ♂; June 10, 1 ♀; June 14, 1 ♂, 1 ♀; June 19, 1 ♀; July 1, 1 ♂; Hacienda No. 2, Col. Perene, June 8, 3 ♂; June 15, 1 ♀; Iquitos, Aug. 5, 1 ♀.

Brazil: Manaos, Sept. 7–9, 1 ♀; Bello Horizonte, Minas Geraes, Nov. 1–6, 1 ♀.

British Guiana: Kartabo, Bartica Dist., Oct., 1 ♀; Georgetown, Nov. 10–20, 1 ♂.

This series shows great variation in the extent of the apical markings of the primaries. In this area some specimens have merely dark lined veins, while a few have a solid dark patch. The majority have this patch very lightly marked between the veins and with a preapical series of white spots.

Urbanus alana Reakirt

Miriatiriañi, Rio Aguachini, Cam. del Pichis, Peru, July 10, 1 ♂.

Urbanus omrina Butl.

Iguazu Falls, Argentina, Jan. 22, 1 ♀, (Parish).
Huacapistana, Rio Tarma, Peru, June 1–2, 1 ♂.
Bello Horizonte, Minas Geraes, Brazil, Nov. 4, 1 ♂.
Itapura, Matto Grosso, Brazil, Dec. 2, 1 ♂.

Chiomara asychis Cram.

Taboga Is., Panama, Apr. 8, 1 ♂; Apr. 11, 1 ♂.
Corumba, Matto Grosso, Brazil, Dec. 15, 1 ♂.

The Panama specimens are much paler, due to reduction of the gray brown areas.

Chiomara mithrax Mösch.

Alta Parana River, Argentina-Paraguay, Jan. 23, 1 ♂.

Chiomara marthona Schaus

La Chorrera, Putomayo Dist., Peru, Aug. 20, 1 ♀.
La Chorrera to La Sombra, Aug. 21, 1 ♀.

Erynnis gesta H.-S.

El Campamiento, Col. Perene, Peru, June 4 to 27, 19 ♂, 11 ♀.
Hacienda No. 2, Col. Perene, Peru, June 8, 1 ♀.
Pueblo Pardo, Chanchamayo, Peru, June 17, 1 ♂.
Dos de Mayo, Rio Ucayali, Peru, July 25, 1 ♂, 1 ♀.
Rio de Janeiro, Brazil, Oct., 1 ♂, 1 ♀ (R. C. Harris).

Erynnis zephodes Hbn.

Charlotte Amalia, Virgin Is., Nov. 20, 1 ♀.

Erynnis funeralis Scud. & Burg.

Matucana, Peru, May 27, 2 ♂.

These specimens have more dark scales in the fringes than is usual in North American specimens.

HESPERIINAE

(Pamphilinae Auct.)

Butleria calcus Hew.

Huacapistana, Rio Tarma, Peru, June 1–2, 2 ♂.

Butleria jelskyi Ersch.

El Campamiento, Col. Perene, Peru, June 10, 1 ♂.

The figure given by Draudt in Seitz's work emphasizes the basal dash on the primaries excessively. In the specimen at hand this is not at all evident, though there is evidence that it may have been marked by pale hairs. Reference to the original description and figure has established the validity of the identification.

Butleria diraspes Hew.

Rio de Janeiro, Brazil, Oct. 18, 1 ♀.

This specimen, from the type locality, is apparently the "unnamed" *Butleria* mentioned by Godman and Salvin under *B. lalage* in the *Biologia*.

Butleria ibhara Butl. Pl. xxix, fig. 4.

Tambo Eneñas, Camino del Pichis, Peru, July 4, 1 ♂.

Butleria agathocles Feld.

Huacapistana, Rio Tarma, Peru, June 1–2, 3 ♂.

Butleria quadripuncta n.sp. Pl. xxix, fig. 5.

Expanse of type 27 mm.

Body dark above with some tawny and grayish hairs. Under surface with more of the pale hairs. Head with some whitish scales in front of and below eyes. Palpi broken off. Antennae black above, front of club chestnut brown, lower surface of entire antenna buff, broken into bands on joints near base.

Wings dark brown above, darker terminally and in base of fringes, the latter becoming light brown toward anal angle of secondaries. Primaries with four hyaline whitish spots of moderate size and about equal. Two are preapical, between R_3 and R_4 and R_5 and M_1, and two discal, between M_3 and Cu_2. On the secondaries a faint oblique discal patch and spot in cell are slightly paler than the ground color.

On the under surface the wings are of a warmer shade of brown. The secondaries anterior to the fold, especially beyond the basal area, and the apex of the primaries bear numerous bluish white scales, and have a slight tinge and luster of purple. The preapical spots of the primaries are repeated, with a tiny whitish point in the space between them indicating the third. Discal spots ochre yellow, the posterior larger and merging into a broad yellow suffusion which extends between Cu_2 and A and reaches the inner margin. Markings of secondaries rather difficult to interpret. They

seem to indicate a broad discal band of the usual kind, angled on M_1 and outlined outwardly and basad by a broken slender line of the brown ground color, the band itself being heavily clothed with bluish white scales. In the cell a broad quadrate pale area is similarly outlined, its outer limit being continuous with that of the dark basal area. Beyond the disc a few dark transverse dashes between the veins form a broken line behind the medians. The anal angle is tinged with ochreous and the fringes here have pale bases. On both wings blackish tufts occur in the basal half of the fringes at the veins.

Holotype ♂, Huacapistana, Rio Tarma, Peru, June 1–2, 1920, Cornell University.

This pretty little species is nearest to *agathocles* Feld. but has no distinct spots on the upper surface of the secondaries and no spot in the cell of the primaries.

In the slide of the male genitalia the entire dorsal portion is distorted. The uncus has been drawn as well as possible, but I have been unable to tell whether it curves upward or downward naturally. This part of the figure must therefore be interpreted very liberally and comparisons made chiefly with the valves.

Butleria hilina Butl. Pl. xxix, fig. 3.

Huacapistana, Rio Tarma, Peru, June 1–2, 2 ♂.

This species and *scylla* Ménétries are said to be the same.

Butleria cypselus Feld.

Tambo Eneñas to Dos de Mayo, Cam. del Pichis, Peru, July 5, 1 ♀.

Butleria mesoxantha Plötz

Tambo Eneñas, Cam. del Pichis, Peru, July 4, 1 specimen.

Godman (Ann. & Mag. Nat. Hist. (7), xx, 146) states that it is a variety of *cypselus*, which seems quite probable.

Pamphilida daridaeus Godman

San Juancito (Panama?), Feb. 27, 1 ♀.

This specimen lacks antennae and palpi so its generic position cannot be checked. In all remaining structures it agrees with the genus in which it was described, *Pamphila* Auct.

Apaustus menes Cram.

Mouth of the Rio Teffé, Rio Solimões, Brazil, Sept. 5, 1 ♂.

Chaerephon pudorina Plötz. Pl. xxvi, fig. 10; xxx, fig. 11.

Lima, Peru, May 2, 1 ♀.
Hacienda de San Juan, Col. Perene, Peru, June 16, 2 ♂.
La Chorrera, Putomayo Dist., Peru, Aug. 20, 1 ♂.
Manaos, Brazil, Sept. 7–9, 1 ♂.
Bello Horizonte, Brazil, Nov. 6, 1 ♂.

Hylephila phylaeus Drury

Darien, Canal Zone, Panama, Mar. 31, 1 ♂.
Ancon, Canal Zone, Panama, Mar. 20, 1 ♀; Apr. 5–6, 1 ♀.
Lima, Peru, May 1, 1 ♂; May 16, 2 ♂.
El Campamiento, Col. Perene, Peru, June 4–7, 1 ♀.
Hacienda de San Juan, Col. Perene, Peru, June 16, 1 ♂.
Buenos Ayres, Argentina, Feb. 8, 2 ♂.

Posadas, Misiones, Argentina, Jan. 24, 1 ♂.
Gastries, St. Lucia, Sept. 10, 1 ♂, (J. C. Bradley).
Bridgetown, Barbados, Dept. 24, 1 ♂.
Penal Settlement, Bartica Dist., British Guiana, Oct. 7, 1 ♂.

Hylephila isonira Dyar

Matucana, Peru, May 13, 1 ♂; May 26, 3 ♂.

Atalopedes campestris Bdv.

Ancon, Canal Zone, Panama, Mar. 2, 1 ♀; Apr. 5–6, 2 ♂.

Talides athenion Hbn.

Old Panama, Mar. 23, 3 ♂.
Near River Trinidad, Gatun Lake, Panama, Mar. 25–27, 1 ♂, 1 ♀.
Canal Zone, Panama, Mar. 30, 1 ♂.
El Campamiento, Col. Perene, Peru, June 4–7, 2 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 18, 1 ♂.
Iquitos, Peru, Aug. 3, 2 ♂; Aug. 5, 3 ♂; July 29, 2 ♂.
Kartabo, Bartica Dist., British Guiana, Oct., 1 ♂.
Georgetown, British Guiana, Nov. 10–20, 1 ♀.

Athenion appears to be very closely related to the species included in *Polites*. Since it is the proper type of *Talides* Hbn., which antedates *Polites* by fifty-two years, we shall probably have to substitute Hübner's genus for the one now in use. In a paper of this nature I hesitate to change such a well known name; later it may be possible to give a detailed analysis of the problem.

Polites vibex Hbn. Pl. xxvi, fig. 2.

Huacapistana, Rio Tarma, Peru, June 1–2, 1 ♀.
El Campamienton, Col. Perene, Peru, June 4–7, 1 ♂.
La Sombra, Putomayo Dist., Peru, Aug. 22, 3 ♂.
Bello Horizonte, Matto Grosso, Brazil, Nov. 4, 1 ♂.

Polites brettus Bdv. & Lec.

Ancon, Canal Zone, Panama, Mar. 20, 1 ♀.
Lima, Peru, May 1, 1 ♂, 1 ♀; May 2, 1 ♂; May 9, 1 ♂.
Port of Spain, Trinidad, Oct. 1, 1 ♀.

In connection with the study of this material it has been necessary to revise the current usage of the names *vibex* and *brettus*. In addition to the series of each species taken by Dr. Forbes I have in my own collection specimens from Panama and Brazil and a good series of *brettus* from Florida and Texas. In addition to all of these I have examined the series in the Carnegie and National Museums in reaching the conclusions here expressed.

The genitalia are indistinguishable in the two species, and those of a third, *bittiae*, here described as new, are of the same form. The new species, however, is superficially so different that it will not be confused with the other two.

My attention was first directed to the possible distinctness of *vibex* and *brettus*, which have rather generally been regarded as the same species, or at the most only forms, by the occurrence in the Cornell University material of a single female from Peru which seemed to belong to the *vibex* males, and yet differed strongly from the *brettus* females. In this specimen all of the spots on the upper surface are distinctly yellow fulvous and opaque,

none paler than the rest. On the under surface it differs from the males in the same way that the sexes differ in allied species, i.e., in the extended dark markings and diffuse overscaling, which in this case is gray. The females which can be referred to *brettus* with certainty have the two large discal spots of the primaries paler than the rest, often hyaline and whitish. The under surface in these specimens is also more greenish in color.

The males of *vibex* are easily placed by reference to Hübner's figure. They have the discal patch on the upper surface of the secondaries restricted and more sharply defined than in *brettus*. Specimens of *brettus* occur in which the general darkness of color results in a restriction of this patch. Even in moderately dark specimens the under surface has the paired spots enlarged and sometimes even united to form dark shades, while in the darkest specimens of *vibex* at hand these remain moderate in size. Likewise *vibex* occurs sometimes in pale forms, equivalent to average specimens of *brettus*, but in such specimens the under surface is almost as pale as in the extreme form *brettoides*.

I have seen at least two other names associated with these species in various collections, but have no definite knowledge of them at present. It is certain, however, that there are at least these two very closely allied species, and one more distinct, which have identical genitalia.

Polites bittiae n.sp. Pl. xxvi, fig. 13, 16.

Expanse: ♂ 26–30 mm.; ♀ 26–34 mm.

Body dark, clothed above with tawny and below with pale buff-white scales and hairs. Palpi tawny. Antennae mostly tawny, with the posterior side touched with blackish.

Male: Wings with the usual maculation so extensive that they appear bright yellow-fulvous with only a gray-brown terminal border. On the primaries the entire basal area, running out to the stigma and through the cell and costa usually to the preapical spots, is yellow-fulvous shot with gray-brown at the base. The stigma is gray, outlined in fresher specimens with velvety black and followed by a slight blackish patch. It is joined more or less thickly to a gray-brown patch beyond the cell, which connects with the marginal band in some specimens. The spots making up the usual transverse band are large, separated only by the dark veins, and occur in every space from costa to inner margin. The two opposite to the cell are set outside of the preapical spots, thence the band is evenly oblique to the inner margin. There is a tendency to prolongation of the posterior angle of each spot behind M_3 outward a short distance along the vein, but this is inconstant, varying on opposite sides of the same specimen in one case. The disc of the secondaries from base through cell, along M_1, and slightly in front of this vein is yellow-fulvous. This area is cut by blackish veins and blends into the gray-brown border of the wing, but shows a moderately distinct outline. In the fold a line of yellow-fulvous cuts through the fringes, which are yellowish buff suffused with gray at apex of primaries. Under surface of primaries with base black, running out sharply to end of stigma. Marks of upper surface repeated, of same color on costa and disc, becoming paler toward inner margin and suffused with pale ochre scales at apex. Secondaries also suffused with pale ochre scales, the fold tinged

with yellow-fulvous. The base shows a concealed gray area, terminating in two dark spots in cell and behind, and with a similar grayish terminal band which shows inwardly two vague darker spots before M_1 and two behind M_3. All of these spots are arranged as in *vibex* and *brettus*, leaving a clear discal band, but the wing has a distinctive smooth grayish ochre appearance.

The female is similar to the male, but the stigma is replaced by a gray-brown patch of the same extent, position and relation to other markings. The under surface differs in that the overscaling is whitish or very pale gray, giving the wings a distinctly hoary appearance. The palpi and fore coxae are white.

Holotype ♂, May 13, allotype ♀, May 11, and one male, May 26, from Matucana, Peru; paratype ♂ and one other ♂, Lima, Peru, May 6, Cornell University.

Paratypes ♂ and ♀, Lima, Peru, May 6, 1920, in coll. Lindsey.

The holotype has lost the apex of its left primary, as the figure shows. It is otherwise a beautifully fresh specimen, quite the best of the series, and since it is from the same locality as the better female it seems wise to make the two holotype and allotype.

Catia druryi Latr.

El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 9, 1 ♂; June 27, 1 ♂.
Kartabo, Bartica, British Guiana, Oct., 2 ♂.

Catia ophites Mab.

Gastries, St. Lucia, Sept. 10–22, 1 ♂, 2 ♀, (J. C. Bradley).
Roseau Valley, Dominica, Nov. 18, 1 ♂.

Gemma Plötz and *ravola* G. & S. are synonyms.

Atrytone vitellius Fab.

Charlotte Amalia, Virgin Is., Nov. 20, 3 ♂.

Atrytone mella Godman

Iguassu Falls, Argentina, Jan. 22, 1 ♀, (Parish).
La Sombra, Putomayo Dist., Peru, Aug. 22, 1 ♀.

Atrytone? tristis n.sp. Pl. xxix, fig. 9.

Expanse of type 33 mm.

Body gray-brown above, pale grayish below, tinged with yellow. Head with a few yellow scales. Palpi clothed with black and yellowish scales, blending into a white patch below and behind eye. Antennae black, the club pale tawny below.

Wings evenly gray-brown above with a dark terminal line and a pronounced luster. Fringes paler. There are a few pale scales in the costal region of the primaries, mostly near the base. Stigma soft dark gray.

On the under surface the general color is tawny brown. The costal region of the primaries is marked with grayish tawny and a rather sharply limited apical patch is more brownish. The subapical spots and the two usual discal spots are very faintly indicated in a paler shade, and between the anal and Cu_2 there is a vague, diffuse, pale grayish patch. In the disc of the secondaries the veins are pale, but not conspicuously so. Fringes as above.

Holotype ♂, Iquitos, Peru, Mar. 5, 1920, (Parish), Cornell University.

Both of the middle legs of the type are lacking, so the generic position of the species cannot be determined accurately. If additional material shows the mid tibiae to be spined, it must be removed to the vicinity of *Lerema*, but it does not agree as well in other particulars with this genus as with *Atrytone*, in which it seems to be related to *vestris* in general structure and habitus.

Atrytonopsis? anomala n. sp. Pl. xxvi, fig. 6; pl. xxx, fig. 10

Expanse 32–36 mm.

Light gray-brown. Head with a few whitish scales. Body and palpi with mixed gray and whitish hairs and scales below. Antennae black above, white barred below, with the club mostly white on this surface.

Wings above light gray-brown with grayish tawny scales and hairs in the basal half. Fringes paler, darkest at apex of primaries and cut by concolorous tufts at veins. Secondaries immaculate, primaries with hyaline white spots. Three are preapical, elongate, separated only by the veins. One in the cell is constricted at the middle, and two discal spots lie between M_3 and Cu_1 and the cubitals respectively, the latter larger. In the allotype there is also a faint, small, opaque dot following these on the anal vein.

Under surface of primaries similar in all respects, but with the apical area hoary with very pale lilac overscaling, and a diffuse pale patch in front of the anal. Secondaries paler in the fold, but with the pale lilac overscaling throughout. A row of pale diffuse spots in the spaces crosses the wing from Sc to Cu_2, bent at a right angle outside of the cell. A similar spot lies in the cell and a basal one before it. A fine dark terminal line occurs on both wings and the fringes are paler than above, in sharp contrast to this line, and more distinctly checkered.

The sexes are similar and the male has no stigma.

Three specimens from Huacapistana, Rio Tarma, Peru, June 1–2, 1920; holotype ♀ and allotype ♂ at Cornell University, paratype ♀ in coll. Lindsey.

This species, together with *ovinia* Hew., *rupilius* Schaus, and probably *edwardsi* B. & McD. and *opigena* Hew., seems to mark a rather distinct group, although the genitalia of the new species and *edwardsi* are not similar. I do not feel that Godman's association of *ovinia* with *Thespieus* is correct. Schaus' tentative placing of his species in *Lerodea* seems more accurate, and the form of the genitalia of *anomala* would suggest such a position, but I am retaining McDunnough's use of the genus *Atrytonopsis*. I do this with some hesitation, but it seems at least as certain as any other procedure. The species here described has no trace of a stigma in the one male available, yet its palpi are more like those of *Atrytonopsis* than those of *Lerodea*.

A female is being made the holotype because it is very nearly perfect, while the one male is both worn and torn. There is so little difference between the sexes, even in the wing form, that this is of little moment.

Lerodea eufala Edw.

Huacapistana, Rio Tarma, Peru, June 1–2, 1 ♂.
Bello Horizonte, Brazil, Nov. 3, 1 ♂.
Corumba, Matto Grosso, Brazil, Dec. 20, 1 ♂.

Lerodea tesera Schaus. Pl. xxx, fig. 1

Urucum, Corumba, Brazil, Dec. 24, 1 ♂.

This specimen corresponds with the type in all respects except that the spots on the primaries are much smaller. The type locality is Rio Janeiro.

Lerodea forbesi n.sp. Pl. xxvi, fig. 7, 8; pl. xxx, fig. 6

Expanse 26–30 mm.

Both sexes brownish gray, under surface paler. Abdomen below whitish with a dark median line. Palpi below whitish.

Primaries with whitish diaphanous spots, two in end of cell, the posterior larger, the usual preapical group of three, diminishing in size toward the costa, one, moderate in size, between Cu_1 and M_3, not reaching the bases of these veins, and one, the largest of all, between the cubitals. Behind the last there is an opaque whitish spot on the anal. Of the three preapical spots that next to the costa is reduced or lacking in most specmens, and the middle one is lacking as well in several. The anterior spot of the pair in the cell is also so small in two specimens as to suggest the possibility of its absence in some. The secondaries in a few specimens show faint pale spots between M_3 and Cu_2, of which the anterior is more evident and more frequent in occurrence. The fringes have whitish tips.

On the under surface the primaries are similar but with the apical area ashen, showing a dark apical dash between R_5 and M_1, and a similar smaller dash between R_4 and R_5. Secondaries ashen, the veins slightly darker, each bordered by pale stripes of equal width throughout. These pale stripes limit dark gray dashes in the spaces. A long blackish dash runs from the base of the wing through the cell and forks on the sides of M_2, fading out toward the outer margin. This is well marked only in bright specimens, and in such the dark dash in the space between the cubitals is also blackish at its base. Poorly defined white spots follow the latter dash in the same space and that anterior to it, corresponding to those of the upper surface, and a larger vague white spot appears between R and M_1, preceded by a very faint spot costad of R. All or part of these spots may be absent. The general appearance of the under surface is ashen, with light and dark streaks on the secondaries.

Described from a series of eleven specimens from Peru.

Holotype ♂, Lima, May 9; allotype ♀, Lima, May 16; paratypes ♂ and ♀, Chosica, May 3–4; one male, Lima, May 9, one male, Chosica, May 3 and two males, Chosica, May 3–4, all 1920, Cornell University.

Paratype ♂, Chosica, May 3–4; paratype ♀, Chosica, May 3; and one male, Chosica, May 3–4, in coll. Lindsey.

This is a beautiful little species, somewhat resembling *Lerodea gracia* Dyar, with the types of which Dr. Forbes has kindly compared it.

Calpodes ethlius Cram.

Urucum, Corumba, Brazil, Dec. 17, 1 ♀.

Prenes evadnes Cram.

Puerto Bermudez, Rio Pichis, Peru, July 17, 1 ♂.

Prenes pauper Mab.

Chanchamayo Dist., Peru, 1 ♂.

Prenes nero Fab.

Col. Perene, Peru, June, 1 ♀.
Porto America, Rio Putomayo, Brazil, Aug. 30–Sept. 2, 1 ♂.
Lassance, Minas Geraes, Brazil, Nov. 9, 1 ♂.
Roseau Valley, Dominica, Nov. 18, 1 ♂.
Charlotte Amalia, Virgin Is., Nov. 20, 1 ♀.

Prenes coscinia H.-S.

Lima, Peru, Apr. 30, 1 ♂; May 21, 1 ♂.
Chosica, Peru, May 3–4, 1 ♂.
Matucana, Peru, May 26, 1 ♂; May 27, 1 ♂.

Prenes ocola Edw.

Gatun Locks, Canal Zone, Panama, Mar. 24 1 ♀.
Lima, Peru, May 1 to 9, 8 ♂, 6 ♀.
Hacienda de San Juan, Col. Perene, Peru, June 16, 1 ♂, 4 ♀.
Lower Pachitea, Peru, July 22, 1 ♂.
La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♂, 3 ♀.

Thespieus dalmani Latr.

El Campamiento, Col. Perene, Peru, June 27, 1 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 17, 1 ♂.
El Oriente, Putomayo Dist., Peru, Aug. 18–19, 3 ♂.
Kartabo, Bartica, British Guiana, Nov., 1 ♂.

Thespieus macareus H.-S.

Huacapistana, Rio Tarma, Peru, June 1–2, 1 ♂.

Thespieus peruviae n.sp. Pl. xxvi, fig. 12, 15; pl. xxix, fig. 2.

Expanse 31–33 mm.

Body brownish black with olivaceous hairs. Abdominal segments margined with fine pale lines. Head with white lines above eyes. Under surface, including palpi, grayish white. Antennae whitish below and at base of club.

Wings brownish black above with olivaceous hairs and scales in basal area. Costa and inner margin of primaries most distinctly marked in this way, their color almost ochreous. Primaries with a quadrate spot, slightly constricted at middle, in end of cell; three quadrate preapical spots, the middle one shortest; two slender spots between M_1 and M_2 toward outer margin; a moderately large spot between M_2 and Cu_1 and a still larger one between the cubitals, all translucent white. In addition there is an ochreous tinted spot on the anal. The secondaries are marked with an ochreous spot near the middle of the cell, more or less obscured by hairs, and by a patch on the disc cut by the dark veins into two long spots in the spaces between M_2 and Cu_2, an ochreous spot from these to M_1, excavated within, and a slender spot just in front of this. The resulting patch appears sharply bent on M_1, with a straight outer margin behind this vein. The fringes are distinctly checkered in the holotype, less so in the paratypes, with dark tufts at ends of veins.

The under surface of both pairs of wings is mottled with hoary gray, soft brown and blackish brown, in various shades, with the spots of the upper surface reproduced. The apex of the primaries shows the brown patch so

common in this genus, and the secondaries have a conspicuous white basal dash on the radius, in a dark patch.

Holotype ♂, Matucana, Peru, May 26, 1920, and paratype ♂, Tarma, Peru, May 30, 1920, Cornell University.

Paratype ♂, Matucana, Peru, May 27, 1920, in coll. Lindsey.

The under surface especially in this species is strikingly beautiful. It cannot readily be described in detail, but the figure gives a good idea of the complexity of its shading.

Thespieus matucanae n.sp. Pl. xxvi, fig. 11, 14; pl. xxix, fig. 1

Expanse of type 31 mm.

Clothed with brown hairs above, head slightly paler along margin of eye. This color blends into buff on the under surface of the palpi, legs and body in general. Antennae similar, the club black above.

Wings: The bases of the primaries are golden brown to the stigma, along the costa to the tip of SC and along the inner margin behind the anal as far as the middle of the row of spots. Beyond this they are brownish black sprinkled with brown scales. There are nine spots of brownish buff color, most of which are subhyaline. One in end of cell is rather thickly hour-glass shaped. Three preapical spots are arranged in a row, the middle one smallest. Of two spots beyond end of cell the posterior one is triangular, the anterior slender and opaque. Of the next two, which are as usual the largest, the first is strongly produced along Cu_1, the second is larger, more nearly quadrangular but with a concave outer margin, and is in contact with the apex of the stigma. Behind it an opaque spot extends inward and basad as a dash, spreading broadly onto the anal vein. These last, with the stigma, enclose a triangular patch of the ground color. Fringes blending from buff tipped gray-brown at the apex to buff at the anal angle, with faintly indicated tufts on the veins. Secondaries brownish black, a brown line in the fold, a small brown spot in the cell, and a brown patch in the the disc. The last is straight along its outer margin from M_1 to Cu_2, widest at the latter extremity, with a straight inner margin forward to M_1, where it is narrowest. The small anterior remainder, in front of M_1, forms a right angle in the inner margin and a slightly acute angle with the outer. Fringes buff with brown bases toward anal angle, black toward apex.

The under surface is rust brown. Primaries with base of costa buff, all behind cell black, overlaid toward outer margin with brown. Spots repeated, except the smaller one beyond cell. Subapical spots and inner spot buff, the remainder slightly darker. Apex with a faint shade of whitish scales. Secondaries similar, with whitish scales throughout the costal region and in a patch across middle of cell. Discal patch as above, slightly browner, pale buff anterior to M_1, and definitely extended to the fold, forming an additional angle on Cu_2 in its inner margin. This end of the patch, with a pale basal area, encloses a rather conspicuous dark brown spot, and the basal pale area contains a much smaller dark dot. In addition to these markings there are darker brown shades around the discal patch and in the base, and a pale buff line on the base of the radial.

Holotype ♂, Matucana, Peru, May 27, 1920, Cornell University.

The species is very different from anything known to me, and bears a slight resemblance to members of the genus *Buzyges*.

Tirynthia milesi Weeks. Pl. xxx, fig. 8.
Puerto Bermudez, Rio Pichis, Peru, July 19, 1 ♂.
Niconiades xanthaphes Hbn.
El Campamiento, Col. Perene, Peru, June 19, 1 ♂.
Niconiades caeso Mab.
Kartabo, Bartica, British Guiana, Oct., 1 ♀.
Port of Spain, Trinidad, Oct. 1, 1 ♀.
Niconiades cydia Hew.
El Campamiento, Col. Perene, Peru, June 18, 1 ♂, 1 ♀.
Phemiades propertius Fab.
Puerto Bermudez, Rio Pichis, Peru, July 18, 1 ♂.
Rhinthon alus Godman
Hacienda de San Juan, Col. Perene, Peru, June 16, 1 ♂.
Pueblo Pardo, Chanchamayo, Peru, June 17, 1 ♂.
La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♂.
Cobalus argus Mösch.
Tigre Buenos Aires, Argentina, Feb. 8, 1 ♂.
Cobalus errator Weeks. Pl. xxx, fig. 12
El Campamiento, Col. Perene, Peru, June 27, 1 ♂.
Urucum, Corumba, Brazil, Dec. 29, 1 ♂.
Cobalus percosius Godman
El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 27, 1 ♂.
Cobalus cannae H.-S.
Tigre Buenos Aires, Argentina, Feb. 8, 1 ♂, 1 ♀.
Puerto Bermudez, Rio Pichis, Peru, July 18, 2 ♂.
Lower Pachitea, Peru, July 22, 1 ♀.
Cobalus arita Schaus. Pl. xxvi, fig. 4; pl. xxx, fig. 5
Near R. Trinidad, Gatun Lake, Panama, Mar. 25–27, 1 ♂.
Kartabo, Bartica, British Guiana, Oct., 1 ♂.
Cobalus fortis Schaus
Kartabo, Bartica, British Guiana, Oct., 1 ♀.
Cobalopsis dyscritus Mab.
El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 9, 1 ♂; June 19, 1 ♂.
Eutychide paria Plötz
Tambo Eneñas, Cam. del Pichis, Peru, July 4, 1 ♂; July 5, 1 ♀.
Phanes justinianus Latr.
El Campamiento, Col. Perene, Peru, June 4–7, 1 ♂; June 27, 1 ♂.
Euroto compta Butl.
Above Obidos, Amazon, Brazil, Sept. 10, 1 ♂.
Iquitos, Peru, Feb. 28, 1 ♂, (Parish).
Euroto lyde Godman
Trinidad R., Panama, Mar. 25, 1 ♂.
Urucum, Corumba, Brazil, Dec. 27, 1 ♀.
These specimens would never have been placed here without the examination of the genitalia. The blue shade so prominent in the figure given in the *Biologia* is much less pronounced, though present as an iridescent sheen, and the veins appear pale as in *compta*. A characteristic feature is

the vague, rather blotchy appearance of the spots. The specimens are somewhat worn, which, no doubt, accounts for the differences mentioned.

Euroto micythus Godman

Taboga Is., Panama, Apr. 8, 1 ♀.
Hacienda No. 2, Col. Perene, Peru, June 8, 1 ♂.
La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♀.
Souza, Para, Brazil, Sept. 16, 1 ♂.
Kartabo, Bartica, British Guiana, Oct., 2 ♂, 3 ♀.

Both the genitalia and the superficial features of all these specimens agree very closely.

Phlebodes chittara Schaus. Pl. xxvi, fig. 1

Kartabo, Bartica, British Guiana, Nov., 1 ♀.

The specimen agrees very closely with the type of the opposite sex in the form and arrangement of the spots.

Lerema miqua Dyar. Pl. xxx, fig. 2

Matucana, Peru, May 11 to 27, 12 ♂, 2 ♀.
Huacapistana, Rio Tarma, Peru, June 1–2, 5 ♂.

Lerema mooreana Dyar. Pl. xxx, fig. 9

Sabana, Panama, Mar. 4, 1 ♂.
Old Panama, Mar. 23, 1 ♂.
Taboga Is., Panama, Apr. 9, 1 ♂, 1 ♀.

The female is placed here with some doubt.

Metron chrysogatei Butl.

Port of Spain, Trinidad, Oct. 1 ♂.

Papias infuscata Plötz

Mouth of the Rio Teffé, Rio Solimões, Brazil, Sept. 5, 1 ♀.

Papias phaeomelas Hbn.

Tarapacá, Rio Putomayo, Peru, Aug. 12, 1 ♀.

Microsema Godman is a synonym of this species.

Papias tristissimus Schaus. Pl. xxv, fig. 2; pl. xxx, fig. 4

Tambo Eneñas, Cam. del Pichis, Peru, July 4, 1 ♂.

Metiscus? huaynai n.sp. Pl. xxviii, fig. 10

Expanse of type 27 mm.

Upper surface in general dark blackish brown, primaries a little paler and more lustrous than secondaries. Antennae black.

Under surface: the palpi have a few yellow scales mingled with the brown vestiture and the base of the antennal club is tawny. The wings are dull brown, but the secondaries anterior to the fold and the costal and apical areas of the primaries have a superficial vestiture of dark rust red. The secondaries also have some pale spots, each marked by a few whitish scales over the brown ground color. One lies in the end of the cell, one between this and the anal angle, just behind Cu_2, and a series of three crosses the disc outside of these. The first, probably two combined, is between the first and third median veins; the other two are smaller and lie in the next two spaces, reaching Cu_2.

Holotype ♂, El Campamiento, Col. Perene, Peru, June 19, 1920, Cornell University.

The rusty brown under surface with its softly defined pale spots, and the

otherwise very dull dark color of the insect are quite distinctive. Its middle legs are lacking, so the genus cannot be determined accurately, but the species has the characteristic minute third palpal joint of *Metiscus* and the genitalia have forked valves. The genitalia were unfortunately broken in mounting, so that only figures of the valve and oedeagus can be given. The name is taken from that of Huayna Capac, the last chief of the undivided Incas before the Spanish conquest.

Mnasitheus cephis Godman

Kartabo, Bartica, British Guiana, Oct., 1 ♂.

Mnasitheus simplicissimus H.-S.

El Campamiento, Col. Perene, Peru, June 11 to 25, 3 ♂, 1 ♀.
Tambo Eneñas to Dos de Mayo, Cam. del Pichis, Peru, July 5, 1 ♀.
Puerto Bermudez, Rio Pichis, Peru, July 12, 1 ♀.
Iquitos, Peru, Aug. 6, 1 ♂.
La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♀.
El Encanto, Putomayo Dist., Peru, Aug. 25, 1 ♂.
Kartabo, Bartica, British Guiana, Oct., 2 ♂.

Mnasilus penicillatus Godman

Gatun Locks, Canal Zone, Panama, Mar. 24, 1 ♂.
Iquitos, Peru, July 29, 1 ♂.

These are scarcely recognizable, but have been definitely placed by the secondary sexual characters and male genitalia.

Mnasilus guianae n.sp. Pl. xxix, fig. 11

Expanse of type 25 mm.

Body gray-brown above, more grayish below. Head with a few ochreous scales, forming dots along the eyes. Palpi clothed with mixed black, ochre and whitish scales. Club of antennae pale below.

Wings gray-brown above with concolorous fringes, tipped with gray. Entire surface lustrous. Disc of secondaries vaguely brighter; primaries with poorly defined groups of ochreous scales marking three preapical dots from the third radial to the first median, the first faintest. Similar but larger spots are present between M_3 and Cu_1, the cubitals, and Cu_2 and the anal. The middle one of these is the largest, and is slightly elongate and oblique. The last is faint, triangular, on the anal, and is preceded by a few ochreous scales which suggest a connection with the preceding.

On the under surface the wings are pale brownish gray with the brassy luster which is so frequent in such skippers. In some lights this luster gives a faint suggestion of green to the ground color, in others a pale cold gray, and sometimes a slightly buff tone. The inner and basal areas of the primaries are darker. The spots of the primaries are reproduced on this surface except that on the anal. On the secondaries small spots, each formed of a few whitish scales, make up a semicircular row across the disc from SC to 1st A, one in each space.

Holotype ♂, Georgetown, British Guiana, Nov. 10–15, 1920, Cornell University.

This is another of the inconspicuous species which are so numerous in the American fauna. It is apparently a true *Mnasilus*. Although it is usually desirable to have a series from which to describe, it is almost im-

possible to identify such forms as this without examination of the genitalia or comparison with authentic specimens, so I have adopted the policy of describing uniques when they are males.

Vehilius illudens Mab.

Gatun Locks, Canal Zone, Panama, Mar. 24, 1 ♂.

Vehilius venosus Plötz

Hacienda No. 2, Col. Perene, Peru, June 4–7, 1 ♂; June 8, 3 ♂, 1 ♀.
El Campamiento, Col. Perene, Peru, June 14, 1 ♂.
Hacienda de San Juan, Col. Perene, Peru, June 23–24, 2 ♀.
Codajos, Rio Solimões, Brazil, Sept. 6, 1 ♀.
Kartabo, Bartica, British Guiana, Oct., 1 ♂.

Vehilius celeus Mab. Pl. xxix, fig. 13

Manaos, Brazil, Sept. 7–9, 1 ♂.

This species was described in *Pamphila*, where it probably does not belong. The specimen at hand does not permit an accurate check of generic structure, but seems fairly close to *Vehilius* and at least more likely to be recognized in this association than in *Pamphila* Auct.

Vehilius saturnus Fab.

El Campamiento, Col. Perene, Peru, July 1, 1 ♀.

Vehilius lugubris n.sp. Pl. xxx, fig. 7

Expanse 20 to 22 mm.

Upper surface blackish brown with a few orange scales about the head and collar and in the vestiture of the palpi. The condition of the type series is such that these markings cannot be made out with certainty. There appears to be a dot behind each eye, one above, and a transverse band between the antennae. The palpi are orange on the sides and are clothed with a mixture of brown and orange scales below. The legs are marked on one side with orange scales. The ventral surface of the body is a little grayer than the dorsal, with buff scales on the posterior margins of the abdominal segments. The pale scales of the ventral surface are more yellowish in several specimens, but above they are very nearly uniform in color.

The wings are of the same color as the body. The primaries are marked by a sinuous row of small spots, one in each space, extending from the third radial to the anal vein. These are powdery, formed of superficial yellowish scales. The one between the cubital branches is largest and set inside of the rest. On the secondaries there are three to five discal dashes, similar to these spots. Fringes concolorous, gray tipped.

On the under surface the wings are dark gray-brown throughout, with a conspicuous purple luster over the costal and apical areas of the primaries and the secondaries anterior to the fold. The veins in these areas are lightly but sharply marked with yellow scales, and there is a fine yellow terminal line. The spots of the upper surface are reproduced on the primaries, but are more whitish. In some specimens they fade out toward the inner margin. There is a row of similar spots on the secondaries from the subcostal to the anal, the one between M_2 and M_3 produced basad and forming a slight angle in the otherwise evenly curved row. Fringes grayish.

Described from a series taken at La Chorrera, Putomayo Dist., Peru.

Holotype ♂, one paratype ♂, one other male and a specimen with broken

abdomen, Aug. 17; one paratype ♂ and one other male Aug. 20; Cornell University.

Paratype ♂, one ♂, and one specimen with broken abdomen, Aug. 17, in coll. Lindsey.

A single specimen from Souza, Pará, Brazil, Sept. 18, 1920, is the most cleanly and sharply marked of all. It is probable that this extreme sharpness of marking is characteristic of fresh specimens, since it is suggested in one of the Peruvian series. The third joint of the palpi is slightly longer than in the other species of the genus.

Vehilius sacchariphila Dyar

La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♀.

Comparison with the type series has established the identity of this single specimen with reasonable certainty.

Megistias tripunctata Latr.

Posadas, Misiones, Argentina, Jan. 15, 1 ♀.
El Campamiento, Col. Perene, Peru, June 4 to July 1, 5 ♂, 4 ♀.
Hacienda No. 2, Col. Perene, Peru, June 8 to 16, 3 ♂, 1 ♀.
Iquitos, Peru, July 29, 1 ♂; Aug. 5, 1 ♂.
Puerto Bermudez, Rio Pichis, Peru, July 12, 2 ♀.
Putomayo, Peru, Aug. 12, 1 ♂.
La Chorrera to La Sombra, Peru, Aug. 17, 1 ♀; Aug. 21, 1 ♀.
Kartabo, Bartica, British Guiana, Oct., 1 ♂.

Megistias labdacus Godman

Gatun Locks, Canal Zone, Panama, Mar. 24, 1 ♀.
Port of Spain, Trinidad, Oct. 1, 2 ♀.

Megistias huascari n.sp. Pl. xxix, fig. 12

Expanse of type 24 mm.

General color dark gray-brown. The body is more grayish below, the palpi clothed with a mixture of light and dark gray scales and hairs, and the antennae are paler than above.

The wings are dark gray-brown above with a brassy luster. Fringes concolorous, becoming paler toward anal angle of secondaries. Primaries marked by two small dull ochreous discal spots, one rounded, between M_3 and Cu_1, and the other larger, oblique, between the cubitals. There are a few pale scales, scarcely evident to the naked eye, in the position of the usual three preapical spots.

On the under surface the secondaries anterior to the fold and the costal and apical areas of the primaries are overlaid with dull grayish tawny scales. These areas also have a brassy luster. The wings are otherwise gray-brown. The discal spots of the primaries are repeated. Fringes as above.

Holotype ♂, Puerto Bermudez, Rio Pichis, Peru, July 19, 1920, Cornell University.

This species is another of the many inconspicuous members of the American fauna which can be identified accurately only by comparison with authentic specimens or by examination of the genitalia. Its name is taken from that of Huascar, an Inca chief.

Megistias vorgia Schaus

Puerto Bermudez, Rio Pichis, Peru, July 12. 1 ♀.
La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♀.

Megistias epiberus Mab.

Yurimaguas, Peru, Mar. 23, 1 ♀ (Parish).
Kalacoon, Bartica, British Guiana, Apr. 20, 1 ♂.
El Campamiento, Col. Perene, Peru, June 10, 1 ♂; June 14, 1 ♀.
Puerto Bermudez, Rio Pichis, Peru, July 12–19, 1 ♂.
Iquitos, Peru, Aug. 1–5, 1 ♀.
Porto America, Rio Putomayo, Brazil, Aug. 30–Sept. 2, 3 ♂, 1 ♀.
Kartabo, Bartica, British Guiana, Oct., 1 ♂.

Most of these specimens lack the transverse row of spots. In several the two largest discal spots are evident, but in no case is the band as complete as in the figure in the *Biologia*. The identification is based on two slides of male genitalia and the superficial examination of these structures in the remaining males.

Megistias leuconoides n.sp. Pl. xxix, fig. 10

Expanse of type 34 mm.

Body gray-brown, more grayish below. Head concolorous. Palpi clothed with a mixture of black and buff scales. A buff patch below and behind eye. Antennae black above, the club buff below almost to the apiculus.

Wings pale gray-brown with the usual brassy luster. Fringes badly worn but apparently concolorous, becoming pale tipped toward anal angle of secondaries. A few buff spots on primaries are moderately well defined basad but diffuse outwardly. Two are elongate preapical spots, in the spaces between R_4 and M_1. One, moderate in size, lies between M_3 and Cu_1. A slightly larger transverse spot lies basad to the last between the cubitals, and the last, rather small, lies behind this on the anal.

On the under side the wings are lighter in color, with the base and disc of the primaries darkest. The spots of the upper surface are reproduced.

Holotype ♂, Porto America, Rio Putomayo, Brazil, Aug. 30 to Sept. 2, 1920, Cornell University.

This species is related to *M. leucone* Godman, which it resembles in general appearance and genitalic structure. The maculation differs, however, in the absence of spots beyond the cell of the primaries and the presence of the spot on the anal, while the secondaries lack a pale discal patch. On the under surface the preapical spots are not lacking, as in *leucone*. There are also distinguishing features in the genitalia of the two species.

Megistias limae n.sp. Pl. xxvi, fig. 9; pl. xxviii, fig. 9

Expanse 23 to 27 mm.

♂ and ♀. Body above with light brown hairs, below whitish, tinged with yellow-brown, the bases of the palpi palest.

Wings above gray-brown, the bases of the primaries and the secondaries behind the radial, except at the extreme outer margin shot with yellow-fulvous. This is much less evident, though of about the same extent, in the females.

Primaries with base of costa anterior to the radial yellow-fulvous, fading out toward end of cell, a similar dash in cell along Cu, and in some specimens a third from base along the anal to the outer spot. In dark males and most females these are smaller, and that in the cell is occasionally the only conspicuous dash. The spots are seven or less in number. One small

subhyaline yellow-fulvous spot lies before the apex between R_5 and M_1, in contact with a small point, sometimes absent, between R_4 and R_5. A small hyaline spot between M_3 and Cu_1, a similar larger quadrate spot opposite to its inner angle between Cu_1 and Cu_2 and a spot near the lower angle of the cell are often finely outlined with opaque yellow fulvous. There is occasionally a tiny opaque spot in the upper angle of the cell. An elongate opaque yellow-fulvous spot just beyond the middle of the anal is sometimes continuous with the basal dash on this vein. Fringes pale tipped, darkest at apex of primaries and palest at anal angle of secondaries.

The under surface is yellow-fulvous excepting the blackish inner half of the primaries and a fine dark basal line in the fringes. The folded inner margin of the secondaries is also dark shaded. The three largest spots and one or two of the preapical spots are reproduced.

Holotype ♂, 4 paratypes ♂, 1 paratype ♀ and two other females, Lima, Peru, May 1; allotype ♀ and 1 ♂, Lima, Peru, May 2; 1 paratype ♂, Chosica, Peru, May 3-4; 2 ♂, Lima, Peru, May 21, all at Cornell University.

Paratype ♂ and paratype ♀ in coll. Lindsey.

Cymaenes tripunctus H.-S.

Puerto Bermudez, Rio Pichis, Peru, July 13, 1 ♀.

Manaos, Brazil, Sept. 7-9, 1 ♂.

Rio de Janeiro, Brazil, Oct. 13, 1 ♂.

This species was tentatively referred to *Cobalus* by Godman, and definitely to *Lerodea* by Skinner and Williams (Trans. Am. Ent. Soc. xlix, 148). It seems to me more closely related to *Megistias* than to either of these, but since *Cymaenes*, of which it is the type, is an older name than *Megistias* I prefer to hold the union of the two in abeyance until I can be more certain of the relationships involved. The female is placed here somewhat doubtfully.

Vorates decorus H.-S.

Kartabo, Bartica, British Guiana, Oct., 1 ♂, 1 ♀.

The valves of the male genitalia have the rounded end more prolonged than is indicated in the *Biologia* (pl. 101, fig. 29), thus throwing the dorsal point relatively further back from the end; the difference seems to be intraspecific.

Vorates tupaci. n.sp. Pl. xxx, fig. 3

Expanse of type 28 mm.

Body dark gray-brown above, soft pale gray below. Head concolorous; palpi with a mixture of black and pale gray scales, blending into whitish along lower margin of eyes. Antennae with shaft and half of club pale below.

Wings lustrous gray-brown above, the fringes tipped with paler scales, more noticeably toward anal angle of secondaries. In the apex of the primaries a few scattered buff scales are visible under a hand lens. These very vaguely indicate the three preapical dots. Between M_3 and Cu_1 a small rounded buff spot is the most conspicuous feature of the wing. The discal spot between the cubital branches is vaguely indicated, of about the same size as the preceding but much less definite. The stigma is velvety black and includes in addition to the two pieces found in the genotype.

as mentioned and figured by Godman in the Biologia, a third small piece between the others and the anal vein.

On the under surface the wings are also gray-brown, the disc of the primaries darker. The apical area of these wings and the secondaries anterior to the fold are sprinkled with a superficial vestiture of pale gray scales. The spots of the upper surface are reproduced, and in addition a zigzag row of four vague gray spots appears on the disc of the secondaries in the spaces from M_1 to Cu_2. There is a fine dark terminal line. Fringes paler, with vague dark tufts at ends of some of the veins.

Holotype ♂, El Campamiento, Col. Perene, Peru, June 27, 1920, Cornell University.

The name of the species is taken from that of Tupac, one of the greatest rulers of the Incas. It is a beautiful little insect as compared with the general inconspicuous nature of these genera.

Pereneia, new genus

Antennae less than one half as long as costa of primaries, just reaching middle as specimens are usually spread. Club about one-third length of antenna, moderate; apiculus about twice diameter of club. Palpi upturned, third joint erect, moderate. Fore tibiae with epiphysis; mid tibiae without spines. (Hind legs lacking in type.)

Costa of primaries very slightly and evenly convex, more strongly, as is usually the case, at humerus and apex. Outer margin convex, shorter than inner. Secondaries rounded, weakly lobed at anal angle. General form much as in females of *Polites*. The stigma is faint, of the oblique form, made up of three parts. One, just before end of cell between cubitals is oval, about twice as long as wide, the next is a small longitudinal piece behind the second cubital, and the third is similar to the first, just in front of the anal. R_1 of primaries arises just beyond middle of cell. M_2 is gently curved at base, arising about one and one-half times as far from M_1 as from M_3. M_3 arises about equidistant from M_2 and Cu_1. Cu_2 is slightly nearer base of wing than end of cell. M_2 of secondaries equidistant from M_1 and M_3. Cu_1 well before end of cell, slightly further than this from Cu_2, which arises beyond middle of cell.

Type *Pereneia pandora* n.sp.

Pereneia pandora n. sp. Pl. xxix, fig. 6.

Expanse of type 27 mm.

Upper surface dark brown. Head, collar and patagia with a bright blue-green metallic luster when illuminated at the proper angle. This luster is quite invisible when viewed directly. Head with a few tan scales before and behind eyes. Palpi with black and whitish scales, and a few tan scales on the sides. Terminally and laterad they show a slight trace of green luster. Under surface of body grayish. Antennae black, proximal half of club pale below.

Wings dark, dull brown above. The primaries have faint pale suffusions in the position of the ordinary preapical and two discal spots. They also show a metallic luster of a peculiar dull blue-green, varying to brassy green according to the angle of view. This is lacking on the secondaries. There is a dark terminal line before the gray-brown fringes. On the under surface

the wings are a warmer shade of dark brown, the primaries paler behind Cu_2 and the secondaries behind 1st A. The latter are of a deeper and warmer shade than the former. The diffuse spots of the primaries are repeated but are larger and are supplemented by two in the spaces beyond the end of the cell, forming a continuous band. There is a similar faint series from M_1 to Cu_2 on the secondaries. Both pairs of wings have a brassy luster on this surface, greenish in some views, but it is slightly more conspicuous on the primaries. Fringes gray-brown.

Holotype ♂, El Campamiento, Col. Perene, Peru, July 1, 1920, Cornell University.

The elusive beauty of this species is evident only under a lens, with manipulation to secure all possible angles of reflection. It is structurally peculiar, the form of the genitalia suggesting *Mnaseas* while in general structure it seems nearer *Vorates*. Reluctant as I am to establish new genera in a group where generic values are very poorly understood, it seems unavoidable in this case.

Molo schausi n.sp. Pl. xxix, fig. 8

Expanse 30 to 34 mm.

Male: Body above black with yellow-brown hairs, touched with rust-red on head and collar. Similar below, legs mostly ochreous except femora which are largely black. Palpi with dull rusty yellow vestiture. Antennae black above, banded with yellow below and with basal half of club yellow below.

Upper surface of wings dark brownish black, fringes tipped with yellow-fulvous. The primaries have a yellow-fulvous patch in end of cell, extending basad in palest specimen in two dashes. Costa yellow-fulvous near base, this patch merging into that in cell in palest specimen. Two preapical spots, a small one between R_4 and R_5 and one twice as large or more between R_5 and M_1. One small spot beyond cell next to M_3 in two palest specimens, a wedge shaped spot between M_3 and Cu_1, a larger quadrate spot between the cubitals, a more oblique spot between Cu_2 and the anal, and a dash from the outer limit of the last tapering to base of wing along inner margin are all bright yellow-fulvous. The secondaries have a basal dash in the cell, broadening outwardly, a broad discal patch from the radial to behind Cu_2, widest behind, irregular basad, and scarcely separated from the outer margin, and a dash from the base almost to the outer margin along the fold, broadened where it passes the basal extremity of the discal patch and joined to this by a pale suffusion in the palest specimen. All spots of same color as those of primaries.

Under surface of primaries black except costal and apical areas, which are suffused with yellow and rust-red. Spots repeated. Preapical spots larger with a faint indication of a third anterior spot. Dash near inner margin smaller and lying along the anal, lacking in darkest specimen. All more yellowish. Secondaries black in fold with a yellowish marginal spot at anal angle. Inner margin yellowish in palest specimen. A spot in end of cell is yellowish and the discal band is repeated, much narrower, with its ends yellowish. Otherwise the wing is entirely suffused with deep rust-red.

Female: The one specimen is badly worn. Its palpi show yellowish scales and the head a few pale scales, otherwise dark. Wings dull gray-brown above. Primaries with diffuse buff spots in apical angle of cell, in spaces between R_4 and M_1, related as in male, and in the spaces between M_3 and Cu_2. The last are very dim. Another, still more obscure, follows them just behind Cu_2. Secondaries immaculate. Under surface of primaries as in average male but with spots buff, the posterior dash lacking and the rusty suffusion less evident. Secondaries with the fold blackish, the anal angle with a slight buff spot, and the remainder of the wing rusty. A faint yellowish spot beyond end of cell is the only other indication of markings.

Type series of four specimens from El Campamiento, Col. Perene, Peru.

Holotype ♂, June 9, allotype ♀ and paratype ♂, June 19, the last two taken in copulation, Cornell University.

Paratype ♂, June 10, in coll. Lindsey.

The series is so variously broken that it has been hard to select types. The three males are respectively dark, darker and darkest. The medium specimen is worn, but has both palpi and one antenna, and has been selected as the holotype. The lightest is torn and lacks palpi. The darkest is both worn and torn but has a full set of appendages. It was taken in copulation with the badly worn and torn allotype, but seems too extreme in color to be made the holotype. There can be no doubt that all belong to the same species.

The pattern of these insects shows close relationship with that of *heraea* Hew. and *nebrophone* Schaus. I have notes on the series of the former in the Carnegie and National Museums and on the type series of the latter. In *heraea* the males are much brighter, due to the more extended maculation, and the females have sharply limited spots above and much yellow on the under surface of the secondaries. *Nebrophone* is closer to the new species but in the type series the humeral half of the under surface of the secondaries is bright yellow. The similarity of the three suggests that they must be either very recent species or adapted to very slightly different conditions.

Padraona epictetus Fab.

El Campamiento, Col. Perene, Peru, June 9, 2 ♂; June 19, 2 ♂.

Iquitos, Peru, Aug. 3 to 6, 6 ♂.

San Antonio del Rio Cotuhé, Peru, Aug. 12, 3 ♂.

La Sombra, Putomayo Dist., Aug. 22, 1 ♀.

Padraona lento Mab.

Tambo Eneñas to Dos de Mayo, Cam. del Pichis, Peru, July 5, 1 ♀.

Boa Vista do Jaquiri, Mouth of the Rio Teffé, Brazil, Sept. 5, 1 ♀.

This species is placed in *Padraona* with some misgivings. Mabille associated it with *epictetus*, to which it shows superficial similarity, but structurally it seems to belong nearer to the beginning of the subfamily. The two specimens at hand are in such poor condition that I cannot place them to my satisfaction.

Carystus marcus Fab.

El Campamiento, Col. Perene, Peru, June 10, 19, 29, and July 1, 4 ♂.

Carystus diversus H.-S.

Huacapistana, Rio Tarma, Peru, June 1–2, 1 ♂.

Carystus fantasos Cram.

Taboga Is., Panama, Apr. 10, 1 ♀.

Carystus artona Hew.

Iquitos, Peru, Aug. 1–5, 1 ♀.

Carystus coryna Hew.

Yapaz to Eneñas, Cam. del Pichis, Peru, July 3, 2 ♂.

Tambo Eneñas to Dos de Mayo, Cam. del Pichis, Peru, July 5, 1 ♂, 1 ♀.

Carystus calvina Hew.

La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♀.

Paracarystus rona Hew.

El Campamiento, Col. Perene, Peru, June 9, 10, 29, 3 ♂.

Paracarystus hypargyra H.-S.

El Campamiento, Col. Perene, Peru, June 9, 1 ♂.

Zenis minos Latr.

El Campamiento, Col. Perene, Peru, June 14, 1 ♀.

Port of Spain, Trinidad, Oct. 1, 1 ♀.

Vettius triangularis Hbn.

El Campamiento, Col. Perene, Peru, June 9, 1 ♂; June 29, 1 ♂.

La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♀.

Tarmia, new genus

Body moderate in size in proportion to spread of wing. Palpi oblique, second joint with deep vestiture, third moderate, conical. Antennae a little over one-half length of wings, in a spread specimen almost reaching end of cell. Club only about one-fifth as long as entire antenna; apiculus much over twice diameter of club, but not sharply reflexed. Fore tibiae with epiphysis. Mid tibiae with short spines. Hind tibiae with two pairs of spurs and a few short spines.

The wings are broader and more elongate than in most Pamphilinae, suggesting those of *Poanes*. The primaries have a straight costa, strongly rounded at humerus but only slightly at apex. Outer margin slightly convex, inner slightly sinuous. Secondaries broadly rounded, not lobed at anal angle. The stigma is a very inconspicuous dark gray mark in the angle of Cu_2 and the cell. It projects along the cell to Cu_1 and a little less along Cu_2. Neuration: In the primaries R_1 arises near middle of cell, M_2 about twice as far from M_1 as from M_3, M_3 equidistant between M_2 and Cu_1 and Cu_2 about three times this distance from Cu_1 and near middle of cell. A faint line indicates a short recurrent vein between M_3 and Cu_1. In the secondaries M_2 is well marked, intermediate between M_1 and M_3. The radial arises well before end of cell, Cu_1 shortly before, and Cu_2 about three times as far.

Type *Tarmia monastica* n.sp.

Tarmia monastica n.sp. Pl. xxvi, fig. 3; pl. xxix, fig. 7

Expanse of type 32 mm.

Body gray-brown above, more grayish below, with some yellowish hairs and one side of each leg pale yellowish. Head with some ochreous scales. Palpi clothed with a mixture of black and yellowish scales. Antennae black above with a few whitish dots at base of club. These project from a whitish line which runs along the posterior side of the antenna, made up of dashes which are widest at the base of each joint.

Wings dull gray-brown above with a slight brassy-green luster. No markings save stigma, which is inconspicuous. Fringes slightly paler. Under surface also gray-brown but with a conspicuous tawny overscaling. This covers the costal and apical portion of the primaries, running back to Cu_1 and tapering along outer margin to anal angle. It covers the secondaries entirely, only a little more sparse in the fold than elsewhere. There are two black preapical dots on the primaries between R_4 and M_1, the posterior one bearing a few pale blue scales. On the secondaries four small spots of pale blue or lavender scales (color varies with illumination) occur between R and M_1, M_2 and M_3, M_3 and Cu_1 and Cu_1 and Cu_2, forming an extradiscal curved row. At the outer end of each of these there is a small black dot. In addition a few blue scales between M_2 and M_3 indicate the possibility of a similar spot in that space. Ignoring the last, the anterior spot is largest, the next smallest and the rest gradually increasing.

Holotype ♂, Huacapistana, Rio Tarma, Peru, June 1–2, Cornell University.

This species is wholly unlike anything known to me. The presence of a trace of the recurrent vein suggests affinity with the genera placed at the end of the Pamphilinae, but these are very different in most characteristics. The genitalia are unlike those of *Godmania* (*Cymaenes* Auct.) which seems fairly near, and this genus differs in other structures as well. It must remain for the present a genus without well marked affinities.

Godmania silius Latr.

Port of Spain, Trinidad, Oct. 1, 1 ♂.

Argentina, (loc?), Feb. 10, 1 ♀, (R. C. Harris).

Methionopsis ina Plötz

El Campamiento, Col. Perene, Peru, June 4–7, 1 ♀; June 9, 1 ♀.

Modestus Godman is a synonym. The association was made by Godman after his examination of Plötz's figures.

Eutocus? quichua n.sp. Pl. xxvi, fig. 5; pl. xxviii, fig. 11

Expanse 25 to 27 mm.

Upper surface brownish black with a few scattered rusty scales and hairs, scarcely evident without the use of a lens. There are more pale scales below, some ochreous and some grayish yellow. Some are scattered in the vestiture of the palpi, others form a pale patch beneath the eye, others color one side of each leg ochreous and still others, the most grayish of all, form two longitudinal lines on the abdomen. The antennae are faintly marked with ochreous scales before the club.

Wings and fringes above of the same brownish black as the body. In the better specimens there are a few ochre scales at the apex of the primaries which are grouped on the veins, forming vague dashes which diminish caudad. Two equally vague dots formed of similar scales are found in the position of the posterior preapical spots usually found in this subfamily and two discal dots between M_3 and Cu_2 are much like the preapical dots. In the ♀ the discal dots are a little more evident; in the male they are preceded by a triangular blackish stigma, less v-shaped than is indicated for the genotype by Godman, lying in the angle of Cu_2 and the cell.

The under surface is also dark brown but slightly warmer in tone. The

inner margin of the primaries is pale gray-brown, otherwise the markings are as above, with the veins more distinctly and extensively marked with ochre in the apical area, where there is also an ochre subterminal line, heaviest at the apex. This line is followed by a dark terminal line, in contrast with the gray-brown fringes. The secondaries are similar. The veins throughout are faintly lined with ochre, the disc is crossed by a row of small ochre spots between the veins, and the terminal dark line is present, preceded by a faint pale area. Fringes gray-brown.

Described from six specimens taken at El Campamiento, Col. Perene, Peru.

Holotype ♂, June 25; allotype ♀, June 26, and two males, June 11 and 26, respectively, at Cornell University.

Paratype male, June 27 and paratype female, June 26, in coll. Lindsey.

None of the specimens in this series of six are perfect, but the holotype and allotype have suffered only from breakage, so that all marks are evident. There are two or three very small spines on the mid tibiae, a character not in accordance with the description of *Eutocus*. The species fits the genus so well in other respects that it seems best placed here, especially since these spines are easily overlooked. It is remotely possible, for the same reason, that they may occur also in the genotype, *E. phthia*, of which I have no specimens. The name *quichua* is taken from that of the tribe of Incas which inhabited Peru.

Callimormus filata Plötz

El Campamiento, Col. Perene, Peru, June 4 to 11, 5 ♂.

Callimormus gracilis Feld.

Yurimaguas, Peru, Mar., 2 ♂, (Parish).
Iquitos, Peru, Aug. 1 to 6, 4 ♂.
San Antonio del Rio Cotuhé, Peru, Aug. 12, 1 ♂.
La Sombra, Putomayo Dist., Peru, Aug. 22, 2 ♂.

Callimormus diaeses Schaus

Gurupa, Brazil, Sept. 12, 1 specimen without abdomen.

Callimormus corades Feld.

Taboga Is., Panama, Apr. 9, 1 ♂.
El Campamiento, Col. Perene, Peru, June 4–7, 2 ♂.
La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♀.
Port of Spain, Trinidad, Oct. 1, 3 ♂.

Lychnuchus celsus Fab.

Tambo Eneñas, Cam. del Pichis, Peru, July 4, 1 ♂.

Thracides polles Godman

Kartabo, Bartica, British Guiana, Nov., 1 ♀.

This, like Dr. Staudinger's one Brazilian specimen mentioned in the *Biologia*, has the spots smaller than in central American specimens and has only one preapical spot. It shows the faint spots on the under surface of the secondaries which are mentioned in Godman's description but not shown in his figure.

Thracides aristoteles Westw. & Hew.

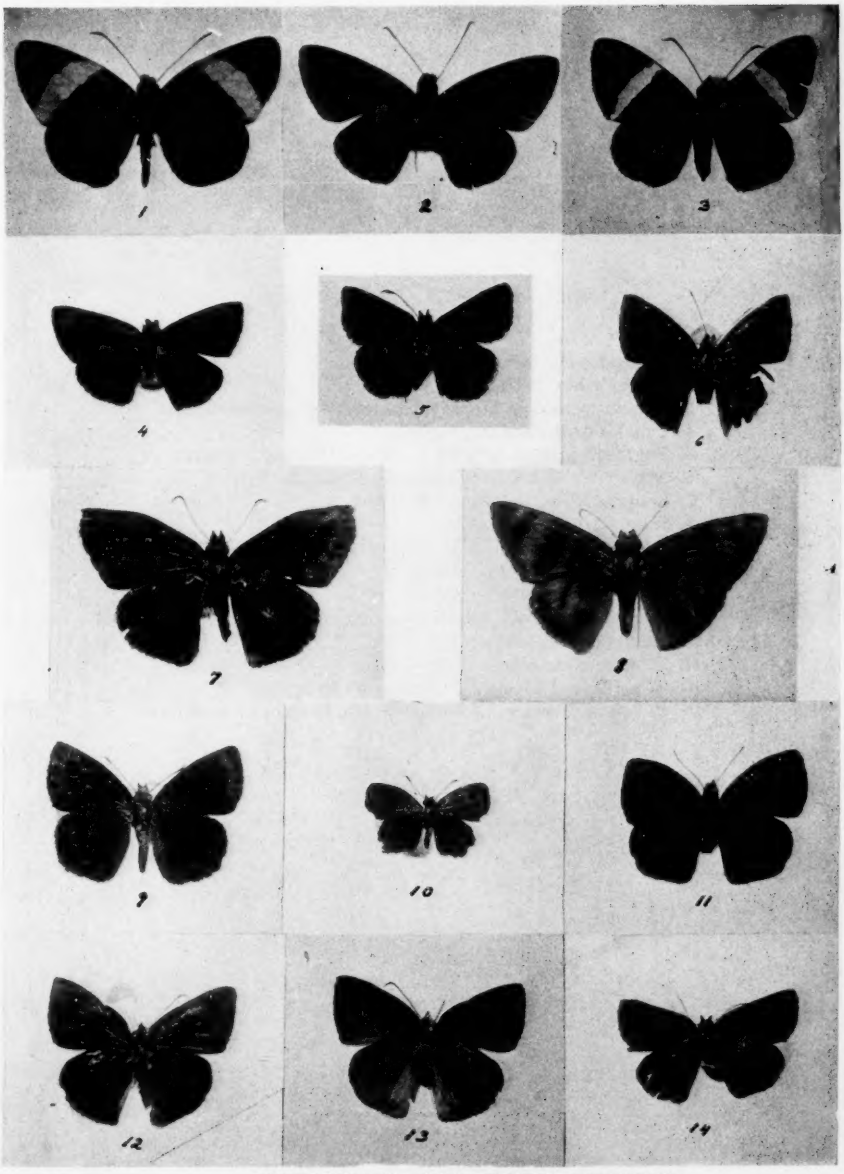
Puerto Bermudez, Rio Pichis, Peru, July 19, 1 ♀.

Thracides longirostris Sepp.
El Campamiento, Col. Perene, Peru, June 29, 1 ♂.
La Chorrera, Putomayo Dist., Peru, Aug. 17, 1 ♂.
El Encanto, Putomayo Dist., Peru, Aug. 25, 1 ♂.
Petropolis, Rio de Janeiro, Brazil, Oct. 26, 1 ♂, 1 ♀, (R. C. Harris).
Perichares coridon Fab.
La Chorrera to La Sombra, Putomayo Dist., Peru, Aug. 31, 1 ♂.
British Honduras, Nov. 6, 1 ♂.
Pyrrhopygopsis orasus Druce
Peru, June 28, 1 ♂, (Parish).
Puerto Bermudez, Rio Pichis, Peru, July 16, 1 ♂.
Pyrrhopygopsis cleanthes Latr.
Hacienda No. 2, Col. Perene, Peru, June 15, 1 ♀.

The figures on plates XXV and XXVI are either natural size or very slightly reduced. The figures of genitalia on the remaining plates are enlarged about twenty diameters.

PLATE XXV

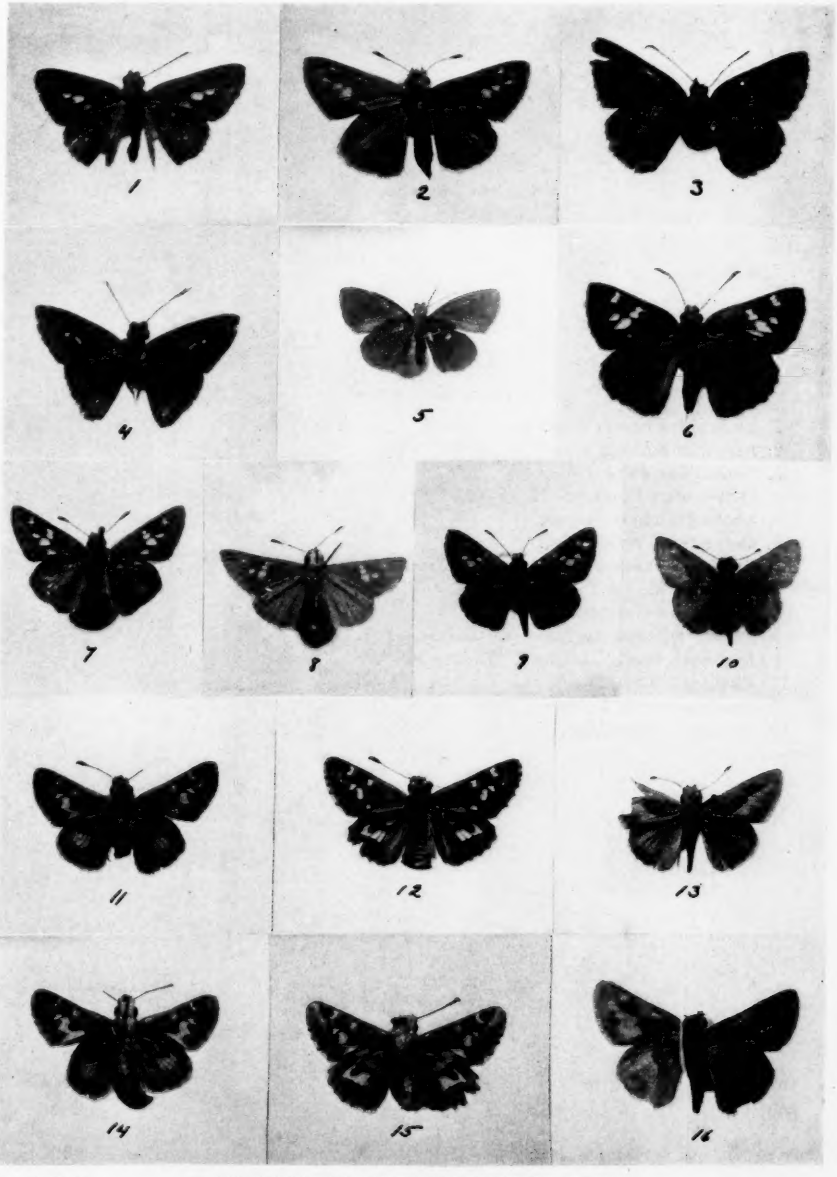
1. Ancistrocampta? clearchus Plötz.
2. Papias tristissimus Schaus.
3. Ancistrocampta? pertica Plötz.
4. Quadrus noctis Lindsey. Holotype ♂.
5. Pholisora cordillerae Lindsey. Paratype ♂.
6. Pellicia inca Lindsey. Holotype ♂.
7. Ebrietas infanda Butler.
8. Anastrus obliqua Plötz.
9. Pholisora atahuallpai Lindsey. Paratype ♂.
10. Pholisora minor Schaus.
11. Pholisora mancoi Lindsey. Holotype ♂.
12. Paches trifasciata Lindsey. Holotype ♂.
13. Same, under surface.
14. Paches styx Lindsey. Holotype ♂.



A. W. LINDSEY. CORNELL UNIVERSITY ENTOMOLOGICAL EXPEDITION

PLATE XXVI

1. Phlebodes chittara Schaus.
2. Polites vibex ♀ Hübner.
3. Tarmia monastica Lindsey. Holotype ♂, under surface.
4. Cobalus arita Schaus.
5. Eutocus? quichua Lindsey. Allotype ♀, under surface.
6. Atrytonopsis? anomala Lindsey. Holotype ♀.
7. Lerodea forbesi Lindsey. Holotype ♂.
8. Same, under surface.
9. Megistias limae Lindsey. Paratype ♂.
10. Chaerephon pudorina Plötz.
11. Thespieus matucanae Lindsey. Holotype ♂.
12. Thespieus peruviae Lindsey. Holotype ♂.
13. Polites bittiae Lindsey. Holotype ♂.
14. T. matucanae Lindsey. Holotype, under surface.
15. T. peruviae Lindsey. Holotype, under surface.
16. P. bittiae Lindsey. Allotype ♀, upper and under surfaces.



A. W. LINDSEY CORNELL UNIVERSITY ENTOMOLOGICAL EXPEDITION

PLATE XXVII

Male Genitalia

1. Eudamidas ozema Hew.
2. Anastrus corbulo Cram.
3. Eudamidas cajus Plötz.
4. Paches styx Lindsey. Holotype.
5. Pholisora minor Schaus.
6. Cecropterus itylus Hbn.
7. Pholisora mazans Reak. a. El Campamiento, Peru. c. Port of Spain, Trinidad. e. Panama.
8. Miltomiges cinnamomea H.-S.
9. Paches trifasciatus Lindsey. Holotype.
10. Pholisora mancoi Lindsey. Holotype.
11. Pholisora oeta Plötz.
12. Quadrus noctis Lindsey. Holotype.
13. Systasea excisus Mab.

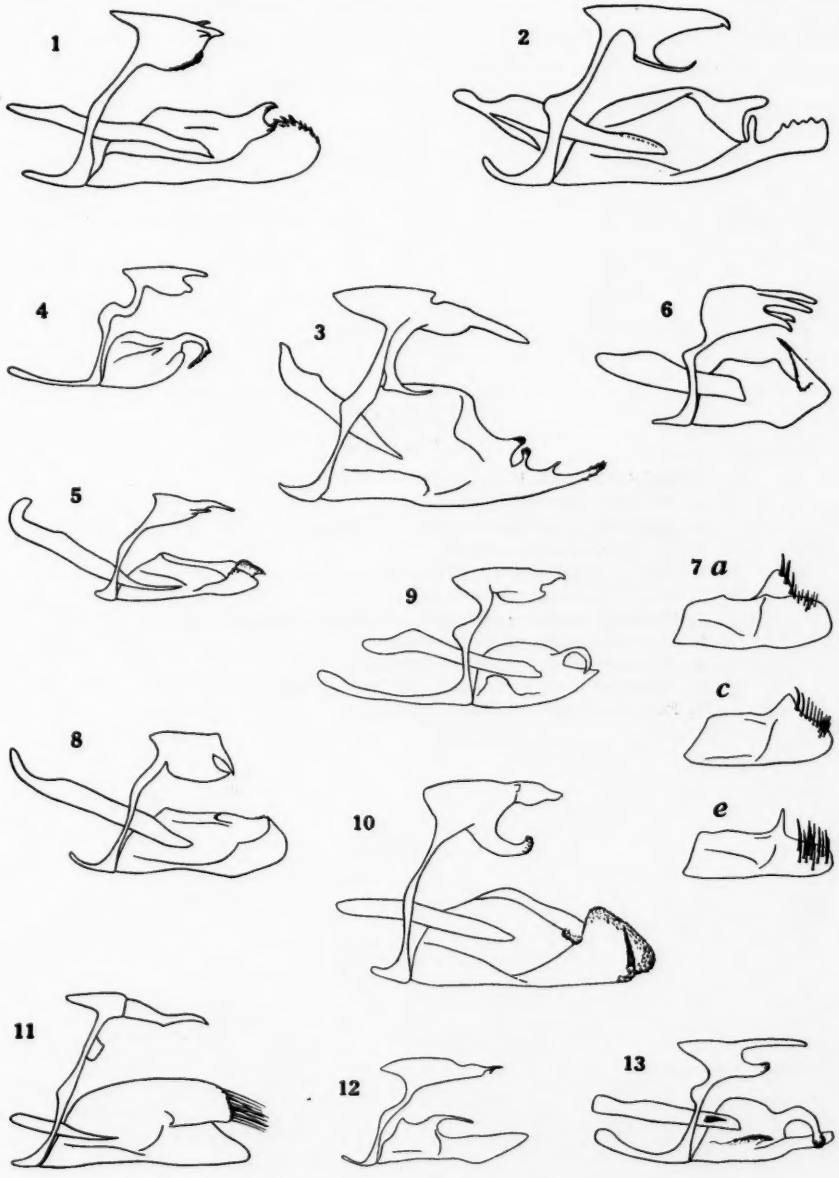

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PLATE XXVIII

Male Genitalia

1. Ebrietas infanda Butl.
2. Physalea vulpecula Plötz.
3. Pholisora atahuallpai Lindsey. Paratype.
4. Codatractus imalena Butl.
5. Pellicia inca Lindsey. Holotype.
6. Camptopleura impressa Mab.
7. Pholisora cordillerae Lindsey. Paratype.
8. Ancistrocampta? clearchus Plötz.
9. Megistias limae Lindsey. Paratype.
10. Metiscus? huaynai Lindsey. Holotype, valve and oedeagus.
11. Eutocus? quichua Lindsey. Paratype.

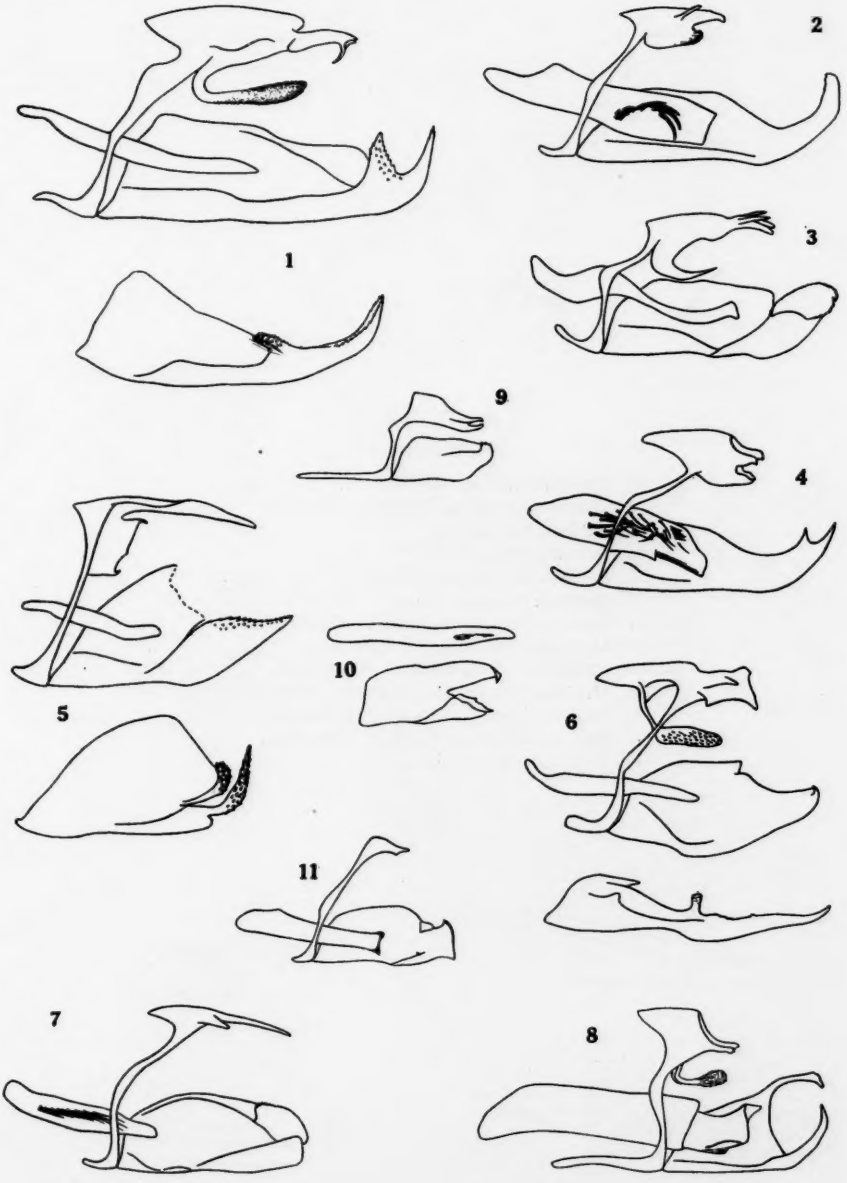
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PLATE XXIX

Male Genitalia

1. Thespieus matucanae Lindsey. Holotype.
2. Thespieus peruviae Lindsey. Paratype.
3. Butleria hilina Butl.
4. Butleria ibhara Butl.
5. Butleria quadripuncta Lindsey. Holotype.
6. Pereneia pandora Lindsey. Holotype.
7. Tarmia monastica Lindsey. Holotype.
8. Molo schausi Lindsey. Paratype.
9. Atrytone? tristis Lindsey. Holotype.
10. Megistias leuconoides Lindsey. Holotype.
11. Mnasilus guianae Lindsey. Holotype.
12. Megistias huascari Lindsey. Holotype.
13. Vehilius celeus Mab.

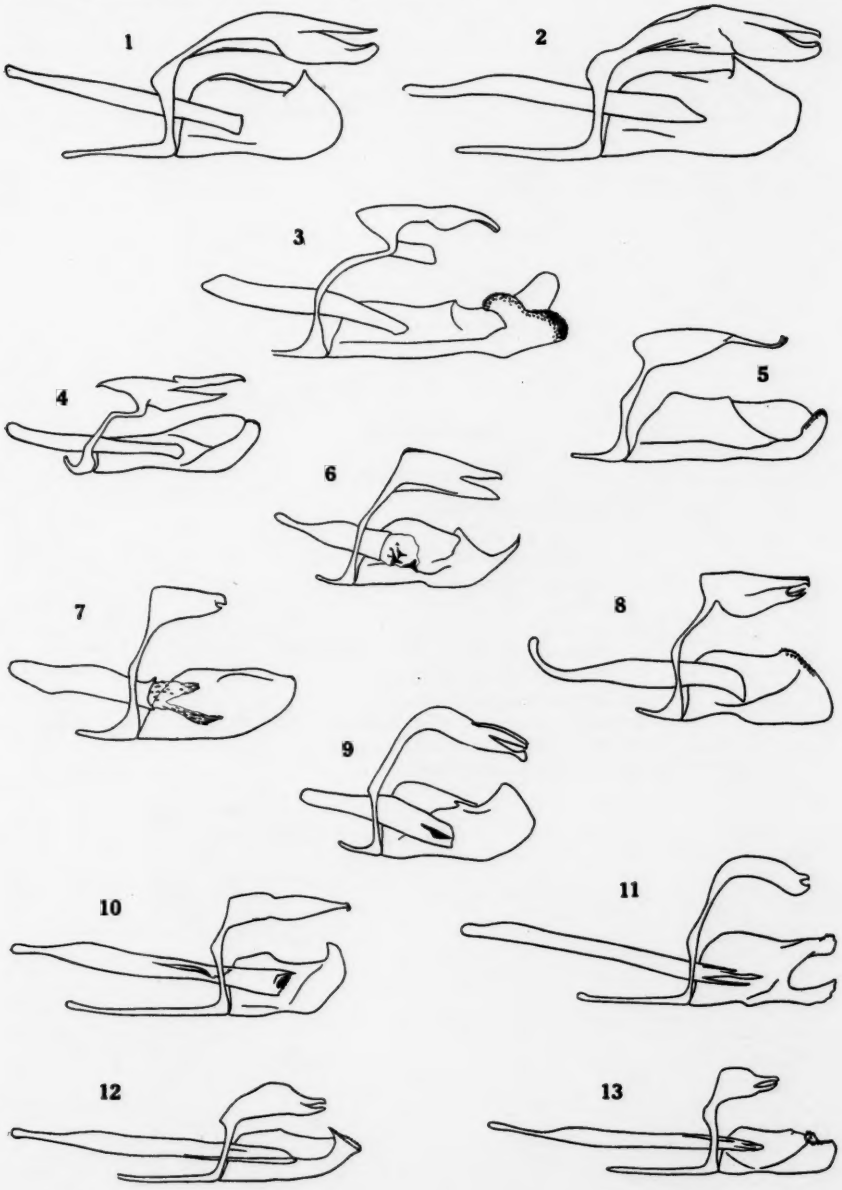
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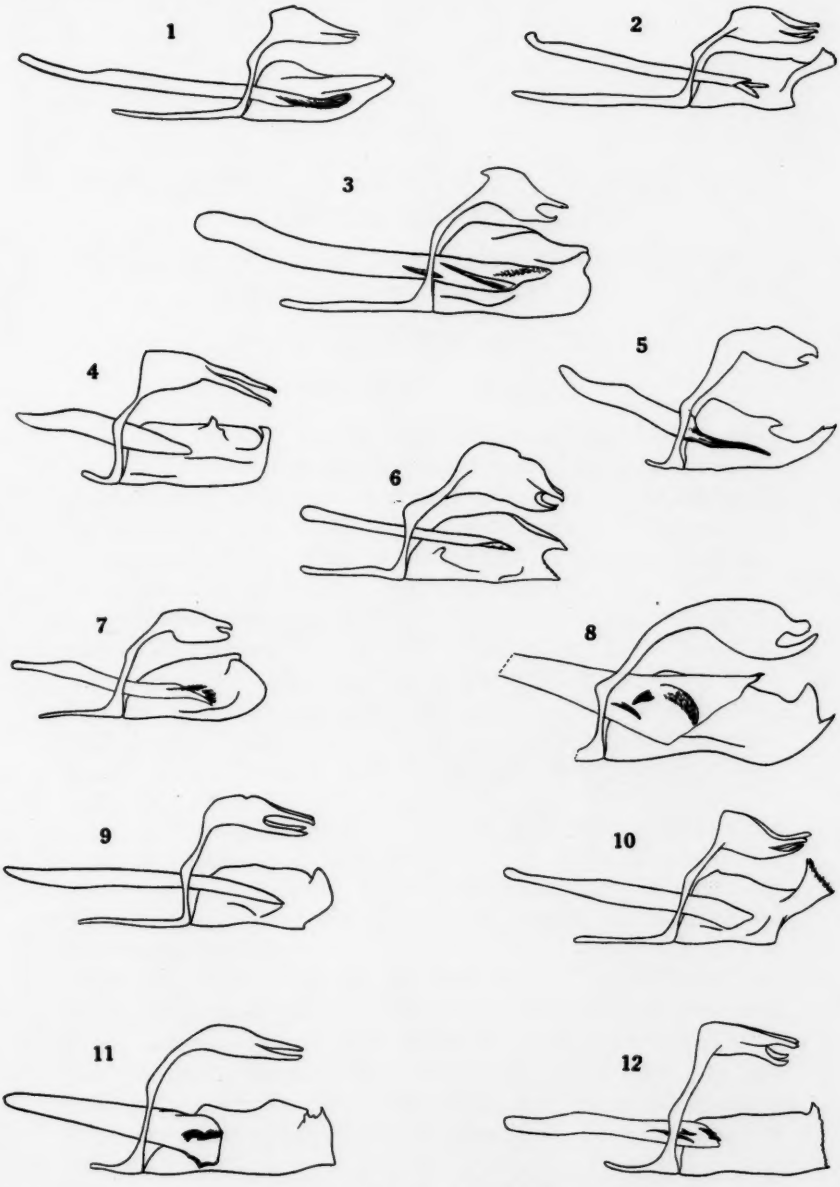
PLATE XXX

Male Genitalia

1. Lerodea tesera Schaus.
2. Lerema miqua Dyar.
3. Vorates tupaci Lindsey. Holotype.
4. Papias tristissimus Schaus.
5. Cobalus arita Schaus.
6. Lerodea forbesi Lindsey.
7. Vehilius lugubris Lindsey. Paratype.
8. Tirynthia milesi Weeks.
9. Lerema mooreana Dyar.
10. Atrytonopsis? anomala Lindsey. Allotype.
11. Chaerephon pudorina Plötz.
12. Cobalus errator Weeks.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PHOTOGRAPHIC RECORD OF THE PARTIAL SOLAR ECLIPSE OF JANUARY 24, 1925

Obscuration at Swasey Observatory, Denison University, About Ninety-five Per Cent

PAUL BIEFELD

DESCRIPTION OF METHOD

An ordinary 3.25″ x 4.25″ plate holder was fitted into a metal case with a circular opening provided with an external thread for the tube that ordinarily takes the various eye-end attachments. To the other end of this tube was cemented an autochrome (orange-yellow) filter made of plane glass. This camera arrangement was attached to the 9″ equatorial telescope.

Star trails were taken on the evening of January 22nd to get the exact focus, and on the following morning trial exposures of the sun were made. The aperture was reduced from 9″ to 0.25″, thus giving sharp images, and the plates holder was so oriented that the star trails ran parallel to the lower edge of the photographic plate. By this means the images were recorded as seen in the sky, along the sun's diurnal circle.

Unfortunately the initial phases of the eclipse could not be recorded because a dwelling house a little south of east of the observatory cut off the view of the rising sun. This accounts for the incompleteness of the photographic record reproduced herewith (plate XXXI).

Cramer's "contrast" plates were used. Twenty-eight exposures were made at intervals of 5 minutes, with the exception of the last three, which were timed for 2.5 minutes in the hope that the last contact might be caught. This hope was not realized, however, for full images of the sun were obtained in all three cases. The last two photographs are therefore omitted from the record.

The times of exposure were recorded on the chronograph by a contact-break operated at the plate holder upon signal given by the writer. The signals were timed by a watch set with the Riefler clock. The Riefler clock (local time) had an error of 30 minutes 3 seconds referred to the Arlington time signals (Eastern Standard Time). The clock was checked against the Arlington signals both before and after the time of maximum obscuration.

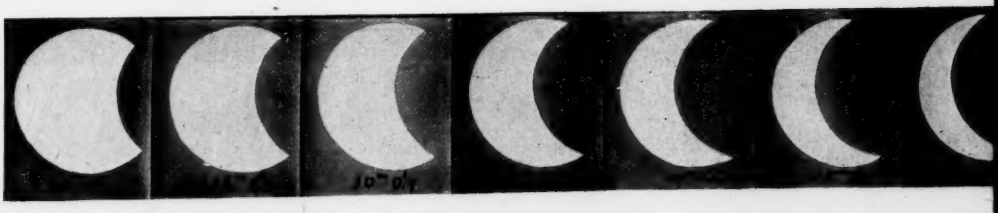
The plate images, 1.25 inch diameter, proved to be fairly sharp; only the one recording approximately maximum obscuration (95 per cent) was somewhat overexposed and showed slight halation.

OBSERVATORY DATA

Latitude, 40° 4′ 45.5″
Longitude West of Greenwich, 5 hours 30 minutes 4.5 seconds.
Log. ρ (including altitude), 9.999424.
Altitude (floor of transit room), 1094.33 feet.

ACKNOWLEDGMENTS

In conclusion the writer acknowledges with thanks the assistance rendered by three Denison University students in carrying out this series of observations. They are Lawrence Biefeld, Townsend Brown and Stuart H. Chamberlain.



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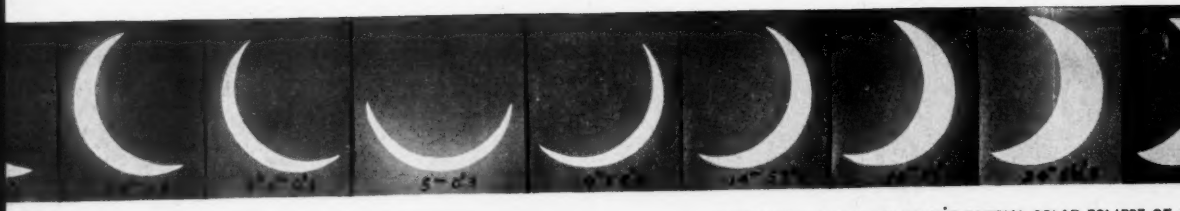
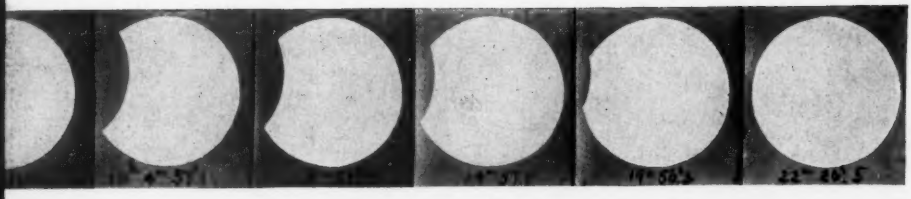


PHOTOGRAPHIC RECORD OF THE PARTIAL SOLAR ECLIPSE OF

LAR ECLIPSE OF JANUARY 24. 1925

PLATE XXXI



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